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NO. 41
May 1977 Mei

THE BIOSTRATIGRAPHY OF THE PERMIAN AND TRIASSIC

PART 3

A REVIEW OF GONDWANA PERMIAN PALYNOLOGY WITH PARTICULAR REFERENCE TO THE NORTHERN KAROO BASIN SOUTH AFRICA

J.M. ANDERSON

BOTANICAL RESEARCH INSTITUTE • DEPARTMENT OF AGRICULTURAL TECHNICAL SERVICES • REPUBLIC OF SOUTH AFRICA

NAVORSINGSINSTITUUT VIR PLANTKUNDE • DEPARTEMENT LANDBOU-TEGNIESE DIENSTE • REPUBLIEK VAN SUID- AFRIKA

Republic of South Africa Republiek van Suid-Afrika

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ISBN 0 621 03834 2

PRICE/PRYS R5,00 OTHER COUNTRIES/BUITELANDS R6,50

BOTANICAL RESEARCH INSTITUTE-NAVORSINGSINSTITUUT VIR PLANTKUNDE

DEPARTMENT OF AGRICULTURAL TECHNICAL SERVICES-DEPARTEMENT VAN LANDBOU-TEGNIESE DIENSTE

SOUTH AFRICA-SUID-AFRIKA

1977

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Foreword

With the publication of a monograph dealing with fossil palynology the Botanical Research Institute is venturing into what is for us a new field of publication.

We are strongly aware that the treatment of the subject of Permian spores in Dr Anderson's work is a drastic one and may prove controversial. Nevertheless, it is evident that synthesis and a uniform approach, have been elements singularly lacking in the field for a long time. The study of such large numbers of samples and the bringing together of this amount of information was obviously a colossal task, which few would be prepared to undertake. As a taxonomist working on living plants, I can only applaud this attempt to follow procedures well known to me, and to apply them in spite of the enormous difficulties which beset such a course of action when dealing with fossils. In my view, one of the biggest problems in palaeobotany, and perhaps one of the most neglected is that only by relating fossils and fossil structures to living plants will a true picture of these plants eventually evolve. A deep understanding of living plants and plant structures as well as of modern methods of taxonomy, it seems to me, are prerequisites to the success of palaeontological studies.

Taxonomy whether it concerns fossil or living plants, should be seen as a single unified subject, in spite of the obvious differences that do exist. Perhaps the closer linking of palaeobotanical studies to institutes dealing with living plants may go some way towards resolving the problems being experienced.

B. DE WINTER
Director: Botanical Research Institute

Pretoria
28th December 1976

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Abstract

The framework of the succession of microfloras as preserved in the Permian strata of the northern Karoo Basin is outlined. The study is based on a selection of 53 assemblages from 12 boreholes and four surface localities. Thirty-three genera and 133 species of miospores are recognized, described and illustrated by 188 plates including nearly 5 500 photomicrographs. The stratigraphic and abundance distribution of each species is plotted graphically and their possible phylogenetic relationships indicated. A zonation scheme incorporating 21 microfloral stages can be recognized for the northern Karoo Permian.

A preparatory examination of 42 selected assemblages from six southern Karoo boreholes has been made in order to gain a provisional understanding of the time relationships between the southern and northern Karoo deposits. These assemblages derive primarily from the Dwyka Tillites and Upper Dwyka shales in which eight microfloral stages can be recognized.

A correlation chart (based on all available data including miospores) of the Permian sequences preserved in the different areas of the Karoo Basin has been compiled.

A review of Gondwana Permian miospores has been attempted; 50 genera and 203 species are recognized from the material recorded to date. The stratigraphic, geographic and abundance distribution of each of the 133 Karoo Permian species is plotted for the Gondwana Permian as a whole.

Uittreksel

Die raamwerk van die suksessie van mikrofloras wat in die lae van Perm-ouderdom van die noordelike Karoo-kom behoue gebly het, word geskets. Die studie is gebaseer op 'n seleksie van 53 versamelings uit 12 boorgate en van vier oppervlakvindplekke. Drie-en-dertig genera en 133 spesies wat in hierdie materiaal erken is, word beskryf en op 188 plate, wat amper 5 500 fotomikrografieë insluit, afgebeeld. Die stratigrafiese en die abundansie-verspreiding van elke spesies word gekarteer en hulle moontlike filogenetiese verwantskappe word aangetoon. 'n Soneringskema wat 21 mikroflorale stadiums insluit, kan vir die Perm van die noordelike Karoo erken word.

'n Voorbereidende ondersoek van 42 uitgesoekte versamelings uit boorgate in die suidelike Karoo is onderneem om 'n voorlopige begrip te kry van die tydverhoudings tussen afsettings van die suidelike en noordelike Karoo. Hierdie versamelings is hoofsaaklik afkomstig van Dwyka-tilliet en Bo-Dwyka-skalie waarin agt mikroflorale stadiums erken kan word.

'n Korrelasiekaart (gebaseer op alle beskikbare gegewens insluitende miospore) van die Permiese opeenvolging in die verskillende streke van die Karoo-kom is opgestel.

'n Oorsig van die miospore van die Perm van Gondwana is onderneem. Daar word besluit dat 50 genera en 203 spesies in die vandag bekende materiaal erken kan word. Die stratigrafiese, geografiese en abundansieverspreiding van elk van die spesies van die Perm van die Karoo word vir die Perm van Gondwana as geheel gekarteer.

Résumé

Cette étude trace le cadre de la succession des microflores telles qu'elles sont conservées dans les couches permiennes du bassin du nord Karoo. Elle est baseé sur un choix de 53 assemblages provenant de 12 forages et quatre sites de surface. Trente-trois genres et 133 espèces de miospores sont reconnues, décrites et illustrées au moyen de 188 planches incluant près de 5500 microphotos. La distribution stratigraphique et l'abondance de chaque espèce sont représentées graphiquement et leurs relations phylogénétiques possibles sont indiquées. Un schéma de zonation incluant 21 stades microfloraux peut être reconnu pour le Permien du nord Karoo. Il a été procédé à un examen préliminaire de 42 assemblages choisis dans six forages du sud Karoo afin de se faire une première idée des relations temporelles entre les dépôts du sud et du nord Karoo. Ces assemblages dérivent primairement des tillites du Dwyka et des schistes du Dwyka Supérieur dans lesquels on peut reconnaître huit stades microfloraux.

On a dressé un tableau de corrélation (basé sur toutes les données disponibles, incluant les miospores) des séquences permiennes conservées dans les diverses régions du bassin du Karoo.

On a tenté de passer en revue les miospores du Permien de Gondwana et 50 genres et 203 espèces sont reconnues dans le matériel observé à ce jour. La distribution stratigraphique, géographique et l'abondance de chacune des 133 espèces permiennes du Karoo est représentée pour le Permien de Gondwana dans son ensemble.

Acknowledgements

To the University of the Witwatersrand for providing a senior bursary during 1967 and SOEKOR for financial assistance from 1968 to March 1973 and to both of these organizations for working facilities rendered I am grateful. To the various members of the staff of both the Bernard Price Institute for Palaeontological Research and SOEKOR who have helped in various ways during the research programme, I extend my gratitude. In particular must be mentioned Roger Davey for initial help with processing techniques; Ian McLachlan for further refinements and considerable help in sample processing and for aid in the collection of samples; Alison Mhlongo for the major part of the processing of samples; Pat Nagel for the bulk of the development and printing of the photomicrographs; Helmud Bars for advice with the Latin and Greek in naming of genera and species; and members of the SOEKOR drawing office for work on the charts and maps.

Sincere co-operation of the mining companies Anglo American, Anglo-vaal, General Mining and Union Corporation and their staff is acknowledged for providing much of the borehole material used in this study.

Numerous friends and acquaintances have helped considerably during the compilation of the completed work. I can mention but two here: Maud Louw who offered considerable time and patience in typesetting the 'species pages' and Annalisa Wegmuller for the pen sketches of the various species of Vittatina, Pityosporites and Lueckisporites. My wife Heidi and father in law Rolf Schwyzer receive my heartfelt thanks for much aid in proof-reading, general comment and encouragement.

To Merwyn Shaw and Colin Evans for the loan of their IBM typesetter and to Exelda Litho for the printing of appendices 9.3, 9.4 and 9.5 and for their wholehearted co-operation throughout I am very grateful.

To the following persons of the Department of Agricultural Technical Services I am much indebted: Dr de Winter for taking on the responsibility of publication, Dr Killick for the onerous task of editorship and Mr Steyn for his patience in guiding the completed work through the press.

The work was originally presented as a Ph.D. thesis at Witwatersrand University under the supervision of Dr R.N. Pienaar to whom I extend thanks.

CHAPTER 1

Introduction

The Karoo Basin occupies roughly one half of the surface area of South Africa. The thickness, completeness and details of the sedimentary succession vary quite considerably from area to area. The strata are almost exclusively of non-marine origin and range in age from low in the Permian to lowermost Jurassic, thus covering a period of time of some 90 million years. Abundant remains of various continental animal and plant groups occur in different horizons. The best represented are the tetrapod vertebrates, macrofloras, and microfloras. The vertebrates and macrofloras have both been subject to considerable scientific interest for over 100 years. The microfloras on the other hand have only relatively recently received attention.

Rilett's paper (1954), dealing briefly with six Middle Ecca coal samples from a single colliery in the Dannhauser district of Natal was the first to appear. Since then the only other papers written have been those of Hart (1963a, 1964b, 1969a, b, c, 1970a, b), who processed and examined some 1 800 Permian samples (600 being productive), primarily from the northern part of the Karoo Basin, whilst working at the Witwatersrand University during the years 1961 to 1966. Five papers deal with particular samples or species and four on the general palynological zonation. Hart (1969a) presented, in summary, the basic results of his research programme, which have been reiterated in two further papers (Hart, 1970a, b) on broader aspects of World Permian microfloras. A full report (Hart, 1966b) of his work was compiled, but has not been published. In it he records by name the occurrence of 63 genera (two new) and 160 species (67 new) of miospores. Unfortunately no photographic illustrations or descriptions of these forms were provided with the result that their context cannot be ascertained. However, reference to Hart 1965b, which comprises a systematic review of the World Permian miospores, with a brief description and single pen sketch for each included species, partly alleviates this problem. A list of the genera and species with their percentage abundance was given for each of the 600 productive samples he studied. A scheme of four microfloral zones for the northern Karoo Permian, from the Dwyka to the Tapinocephalus Zone equivalent (the higher Beaufort strata were not sampled), was proposed. For each zone the more significant species were listed. No borehole cores of the southern and central regions were available to Hart. The reconnaissance surface sampling and processing he conducted in these regions, however, indicated that the microfloras were strongly devolatilized.

The oil exploration drilling programme in the Karoo Basin was initiated by SOEKOR (Southern Oil Exploration Corporation) in 1965. Drilling was initially confined to the southern and central Karoo regions where the thickest accumulations of sediments occurred. By 1970 over ten holes had been completed. The palynological investigations of the present author were originally directed towards the sampling and correlation of the Permian strata intersected by these holes. Over 1 000 samples were processed. Certain sections in certain holes yielded recognizable though poorly preserved, highly carbonized miospores (see 2.2.1). These holes were unproductive and the drilling programme was transferred to the more northerly regions of the basin. In view of the earlier work of Hart, which indicated that well preserved microfloras occurred in the northern Karoo, it was decided that the details of the Permian microfloral succession should be studied in this region and that the southern strata could later be correlated with respect to this succession.

In the work presented here the central aim has been to elucidate the continually changing suite of microfloras as preserved through the Permian strata of the northern Karoo Basin, and to determine whether a zonation scheme of significantly finer resolution than that of Hart (1966b, 1969a, 1970a, b) could be defined and employed in correlations.

With this objective in view sampling was directed towards gathering a reasonably full succession of well preserved assemblages through the preserved Permian stratigraphic sequence. Two significant problems arose in this regard. Firstly, in no single area in the northern Karoo does there occur a complete sequence of 'formations' in their fullest and most typical development. Sampling of different successive 'formations' thus had to be undertaken in different areas. Secondly, although well preserved assemblages do occur in the northern Karoo, they are by no means common. Intrusive dolerites are widespread and have carbonized the microfloras in adjacent strata. Moreover, in many assemblages even when unaffected by dolerites the miospores are badly abraded and broken.

The systematic study of the miospores encountered has presented a serious problem. The basic requirement in any applied microfloral study is a reliable stable taxonomic scheme. Unfortunately in the case of the Permian microfloras, indeed for all Palaeozoic and Mesozoic microfloras, no such scheme is available. A number of the leading workers in the field, notably Schopf (1969), Richardson (1969), Hughes (1969), Kemp & Methvin (1969) and Balme (1970) amongst others have, in recent years, expressed dismay at the confusion into which microfloral taxonomy has so rapidly fallen. If a stable scheme were available it would be sufficient in stratigraphic work simply to give checklists, with abundance data, of the miospores encountered and to proceed directly with whatever discussion or chart compilation were necessary.

In the light of the concepts of populations and species and with the presently available evidence it would appear that in many instances, large numbers of Gondwana Permian species described as distinct can perhaps best be considered as conspecific variants. Moreover, the generic grouping of species have frequently been based on the choice of morphological criteria not intended to reflect phylogenetic relationships. The number of palynological papers (primarily taxonomic) appearing annually has increased dramatically since 1950 such that the total for the Gondwana Permian alone is now over 250. If the northern hemisphere Permian literature together with that for the Devonian to Jurassic of both hemispheres is considered the number of papers would amount to some 2 500. A fully comprehensive taxonomic and nomenclatural review of the Gondwana Permian miospores should take into account at least this spread of literature. An undertaking of such extensive nature clearly could not be followed here. A review based solely on the Gondwana Permian literature has therefore been attempted.

Samples and assemblages

2.1 THE PERMIAN SEQUENCE IN THE KAROO BASIN

Two problems immediately arise in an attempt to describe the biostratigraphic succession of miospores in the Permian sediments preserved in the Karoo Basin. Firstly, the lithostratigraphic nomenclature is at present in a state of flux, and secondly, no synthesis of the recently acquired geological and palaeontological data is available.

2.1.1 Lithostratigraphic terminology

At the time of writing the nomenclature of the lithostratigraphic units within the Karoo Basin is being revised by the South African Committee for stratigraphy (SACS). The change from usage of terms held over from the earliest days of geological mapping in the country to the adoption of new names and terms according to the recently developed international codes of stratigraphic nomenclature and terminology, is presently being made. A preliminary report of the Committee has been made available, but until their proposals are formalized it would be unwise to make broad use of them. The stratigraphic units intersected in the 36 Permian sequences included on Chart 1 have been named according to earlier usage. In referring throughout the present work to the strata encountered in the northern Karoo the old terms Dwyka Tillite, Lower Ecca, Middle Ecca and Upper Ecca are adopted for the lower beds, whilst the divisions of the Beaufort are referred to in terms of the vertebrate zonation scheme of Kitching (1972), i.e. Tapinocephalus, Cistecephalus, Daptocephalus and Lystrosaurus Zones.

2.1.2 Synthesis of relevant stratigraphic data

In recent years a considerable wealth of new data has become available regarding the Permian strata of the Karoo Basin. This information has been gathered through the extensive drilling programme, seismic studies, photogeology, and field work conducted in the search for oil (by SOEKOR) throughout the basin; through the ever growing intensity in the exploration for coal by several mining companies in the northern Karoo Middle Ecca deposits; through drilling programmes directed towards the gold bearing strata beneath the Karoo sediments in the northern Karoo; and through a diverse spread of research and mapping projects being conducted at the universities and the Geological Survey.

No up-dated comprehensive synthesis of this accumulated information on which the present investigation could be based, has yet been made. It has been necessary, therefore, to attempt to synthesize certain relevant aspects here. Chart 1 and Map 1 have been compiled for this purpose.

Chart 1 - Correlation of Permian strata of Karoo Basin

In this chart a framework of the sedimentary succession as preserved in the various areas of the basin is given. The thicknesses and fossil content of the various lithological units are indicated. The numerous papers from which the data are derived are noted.

The Permian sequences encountered at 36 localities (or localized areas) throughout the basin are recorded and correlated with one another and against the available standard reference marine stages and sub-stages for the world Permian. For a full discussion of these reference stages and the problems relating to them, of the Permian time scale and of worldwide correlations based on the available palaeontological, lithological and other data see Anderson (1973). The present scheme is based on the assessment of data presented in that paper. The Karoo Basin strata have likewise been correlated according to a more or less comprehensive consideration of the available palaeontological (including the present palynological survey) and geological data.

The seven stratigraphic units approximating formation rank of the northern Karoo Basin (including the Cistecephalus Zone of the southern Karoo - absent in the north) are discussed briefly in terms of lithology, thickness, palaeogeography, fossil content and correlation in Chapter 6.1.

Map 1 - The Karoo Basin: Fossil localities

The map includes:

(a) The major stratigraphic units approximating group rank of the Karoo Basin (i.e. Dwyka, Ecca, Beaufort and Stormberg) as given in the most recent geological map of South Africa (1970). The Dwyka and Ecca boundaries were mapped according to the earlier concepts of these units, i.e. that the tillites of the northern region and the tillites, Upper Dwyka shales and White Band of the southern region all comprise a natural lithological 'group'. The Dwyka and Ecca outcrops will require remapping in the light of the findings of SACS. The Beaufort is sub-divided into five chronostratigraphic units. These units follow essentially the tetrapod vertebrate zonation of Kitching (1972) and are tentatively extended into areas devoid of vertebrates on an assessment of all further available information (e.g. lithology, palynology, palaeogeography, tectonics).

(b) All known Beaufort vertebrate localities (Kitching 1972); all well substantiated marine invertebrate localities (McLachlan & Anderson, A., 1975); all known Permian macrofloral localities yielding well preserved leaf remains (based on collections at BPI); and all microfloral localities, of the northern and southern Karoo regions, from which assemblages have been selected for study in the present work.

(c) The location of the 36 stratigraphic sections included on Chart 1.

2.2 SAMPLING PROGRAMME AND SELECTION OF ASSEMBLAGES FOR STUDY

(refer to Tables 2 and 3)

The Permian sampling programme was undertaken throughout the geographic and stratigraphic extent of the Karoo Basin, primarily from borehole cores and to a far lesser extent from surface localities. A total of 1851 samples from 36 boreholes and approximately 225 samples from 32 surface localities has been processed and examined.

TABLE 1 - Samples and localities

	No. of samples	No. of localities
Northern Karoo boreholes	771	21
Central Karoo Boreholes	148	5
Southern Karoo boreholes	932	10
Surface localities	225	32

Examination of these 2 000 odd samples indicates that the study of the palynostratigraphy of the Karoo Permian must necessarily be based on northern Karoo material. Well preserved, diverse assemblages although certainly not common, are encountered in the northern region to the extent that a reasonably continuous microfloral succession through the Permian can be studied. Samples from the remainder of the Karoo are in general distinctly less productive, the microfloras when present being less diverse and more highly carbonized and otherwise damaged.

Northern Karoo assemblages selected for study

Fifty-three assemblages from 12 boreholes and four surface localities were selected for study. Fifty-one of these derived from the northern Karoo region, one from the Cistecephalus Zone of the southern Karoo and one from the Middle Ecca of the Springbok Flats. These assemblages were selected with the aim of gaining reasonable representation of well preserved microfloras from each of the major stratigraphic units.

TABLE 4 - Northern Karoo: number of assemblages selected for study from each 'formation'

'Formations'	Assemblages
Lystrosaurus Zone	-
Daptocephalus Zone	2
Cistecephalus Zone	1
Tapinocephalus Zone equivalent	5
Upper Ecca	16
Middle Ecca	18
Lower Ecca	7
Dwyka	4
Total	53

Southern Karoo assemblages selected for study

Of the 932 borehole samples examined, 436 derived from four holes drilled by rotary bit yielding chips and have not been further considered. Of the 496 samples from the six core yielding diamond drilled boreholes 42 assemblages, containing the best preserved miospores, have been examined further. The remaining samples were either barren or contained assemblages too highly carbonized, through the diagenetic effects of proximity to dolerites, depth of burial, or regional effects due to folding in the Cape Fold belt to the south.

The 42 assemblages selected for further examination constitute a fairly good stratigraphic coverage of the Dwyka Tillite and Upper Dwyka Shales (excluding the White Band), and the middle part of the Ecca Shales. They have been subjected only to preparatory study with a view to gaining a provisional understanding of the time relationships between the southern and northern Karoo deposits (see 6.2).

Central Karoo material

The samples from MA 1/69 and SW 1/67 were very highly carbonized and of no value in palynostratigraphy. The remaining three holes yielded a number of assemblages which, though generally poorly preserved, are of potential value in correlation. Due to lack of sufficient material, however, these assemblages have not been considered further in the present study.

2.3 PROCESSING OF SAMPLES

Two basic schemes of sample processing have been followed during the present programme. Initially that adopted by Roger Davey, who worked as palynologist at BPI until 1968, was followed. Subsequently the faster and more efficient scheme

TABLE 2 LOCALITY DATA.

(a) BOREHOLES

(All boreholes sampled during the present study are included).

Regions & areas of Karoo Basin (Chart 1 + Map 1)		Locality code	Farm or townlands	Magisterial district or colliery	Institution responsible	Longitude	Latitude	No. of samples processed.	No. of assemblages selected for study.
NORTHERN KAROO	AREA 23	A 400	Rietkuil 491	Arnot Colliery	Anglo American	29°47'32" E.	25°55'54" S.	30	/
		A 401	Rietkuil 491	Arnot Colliery	Anglo American	29°47'43" E.	25°55'53" S.	27	3
		G 172	Geluk 26	Springbok Colliery	Anglo American	29° 28' 28" E.	26°06' 50" S.	46	1
		UC 621	Goedehoop 290	Bethal	Union Corporation	29° 10' 12" E.	26°32' 50" S.	19	1
		UC 678	Winkelhaak 135	Bethal	Union Corporation	29° 6' 17" E.	26°30' 40" S.	44	4
		WV 3/70	Weltevreden 580	Standerton	Anglo American	28°55' 09" E	26°42' 15" S.	34	1
	AREA 24	UC 608	Rondavel 403	Standerton	Union Corporation	27°02'40" E.	28°59' 10" S.	40	2
	AREA 22	P 12	Petershoogte 1154	Sigma Colliery	General Mining	27°48' 10" E.	26°53' 47" S.	10	/
		P 13	Petershoogte 1154	Sigma Colliery	General Mining	27°48' 15" E.	26°53' 52" S.	28	4
	AREA 20/21	SAP 6/69	Saaiplaas 690	Virginia	Anglo American	26° 50' 40" E.	28°01' 37" S.	87	10
		SAP 7/69	Saaiplaas 690	Virginia	Anglo American	26° 50' 45" E.	28°01' 04" S.	62	9
		OW 1/49	Oostewald 621	Virginia	Anglo Transvaal	26° 55' 20" E.	28°05' S.	61	8
		V 5/50	Virginia	Virginia	Anglo Transvaal	26° 53' 50" E.	28°07' S.	22	/
		UC 713	Kalkoenkrans 225	Virginia	Union Corporation	26°44' 50" E.	28°09' 37" S.	4	/
		UC 729	Jurgenshof 490	Virginia	Union Corporation	26°48' 10" E.	28°03' 40" S.	13	2
		SPG 2	Goedemoed 143	Theunissen	Anglo American	26°45' 40" E.	28°17' 20" S.	10	/
	AREA 19	CL 4/68	Clocolan	Clocolan	SOEKOR	27° 33' 16" E.	28°53' 15" S.	33	/
		WI 1/72	Wittekrans 161	Ficksburg	SOEKOR	27° 41' 14" E.	28°42' 42" S.	8	/
		LA 1/68	Olney Farm	Ladybrand	SOEKOR	27° 28' 51" E.	29° 05' 07" S.	81	4
	AREA 27	BE 1/66	Kromme Draai 1033	Bergville	SOEKOR	29° 23' 14" E	28° 40' 36" S.	76	/
	AREA 28	GSO 18	W. Heslerton 7512	Dannhauser	Geol. Survey	29° 59' 15" E	28°04' 04" S.	26	/
CENTRAL KAROO		WE 1/66	Weltevreden	Aliwal North	SOEKOR	26° 50' 25" E	30°53' 52" S.	85	/
		GL 1/67	Glen	Bloemfontein	SOEKOR	26° 20' 03" E	28° 57' 08" S.	14	/
		SO	Somkele	Hlabisa	Geol. Survey	32° 06' 00" E	28° 21' 00" S.	10	/
		MA 1/69	Matatiele	Matatiele	Geol. Survey	28° 46' 05" E	30°19' 21" S.	20	/
		SW 1/67	Swartberg	Mount Currie	Geol. Survey	29° 16' 00" E.	30°09' 15" S.	19	/
SOUTHERN KAROO		AB 1/65	Abrams Kraal	Victoria West	SOEKOR	22° 37' 05" E.	31°48' 05" S.	138	(14)
		QU 1/65	Quaggasfontein	Fraserburg	SOEKOR	21° 26' 20" E.	31°49' 35" S.	119	(4)
		KL 1/65	Klipdrift	Sutherland	SOEKOR	20° 27' 15" E.	32° 37' 00" S.	75	(7)
		SA 1/66	Sambokkraal	Laingsburg	SOEKOR	21° 19' 45" E.	32°40' 10" S.	62	(7)
		KW 1/67	Klein Waterval	Prince Albert	SOEKOR	22° 20' 12" E.	32° 59' 03" S.	141	/
		SC 3/67	Schietfontein	Aberdeen	SOEKOR	24° 18' 00" E.	32°46' 25" S.	100	/
		CR 1/68	Cranemere	Pearston	SOEKOR	25° 00' 33" E.	32° 29' 07" S.	149	/
		VR 1/66	De Vrede	Graaff-Reinet	SOEKOR	24° 15' 00" E.	32° 15' 30" S.	48	(2)
		OL 1/69	Olyvenbosch	Calvinia	SOEKOR	19° 51' 40" E.	32° 00' 00" S.	54	(8)
		SP 1/69	Springfontein	East London	SOEKOR	27° 45' 48" E	33° 00' 15" S.	46	/

(b) SURFACE LOCALITIES

(Only those 4 surface localities from which assemblages have been selected for study are included.)

NORTHERN KAROO	HKr	Haakdoornfontein 119	Hammans Kraal	–	28°17' 46" E.	25° 28' 00" S.	42	1
	Kb	Kiesbeen 426	Harrismith	–	29° 22' 25" E.	28°15' 50" S.	30	1
	LKf	Langekloof 8281	Bergville	–	29° 04' 55" E.	28° 37' 50" S.	4	1
SOUTHERN KAROO	GrR	Graaff-Reinet	Graaff Reinet	–	24° 32' 09" E.	32° 15' 35" S.	8	1

TABLE 3 ASSEMBLAGE DATA.

(northern Karoo)

Assemblage Code	% counts made	Populations photod	Microfloral zones & subzones		Lithology	'Formations'
Lkf	●		7		Med. dark grey shale with unrecog. plant fragments.	DAPTOCEPHALUS ZONE
Kb	●	●			Med. grey mudst. packed with Glossopteris leaves.	
GrR	●		6		Med. dark grey siltst. with lamellibranchs.	CISTECEPHALUS Z.
OW 94'	●	●	5	e	Med. grey siltst. with unrecog. plant debris	TAPINOCEPHALUS ZONE EQUIV.
OW 159'	●			d		
OW 170'	●	●		c		
OW 312'	●	●		b		
OW 337'	●			a		
SAP 7 278'	●		4	e	Med. grey-med. light grey siltst.	UPPER ECCA
SAP 7 287'	●					
SAP 7 310'	●					
SAP 7 338'	●	●		d	Med. grey-med. light grey siltst.	
SAP 7 464'	●	●				
SAP 6 521'	●	●				
SAP 7 570'	●			c	Med. grey siltst.	
SAP 6 688'	●					
SAP 7 712'	●			b	Med. grey siltst.	
SAP 6 825'	●					
SAP 7 760'	●				Med. dark grey siltst.	
SAP 6 876'	●					
SAP 7 813'	●					
SAP 6 927'	●			a	Med. dark grey mic. siltst.	
SAP 6 944'	●					
SAP 6 991'	●					
│ UC 678 30,6	●	●	3	d	Stringers of dark grey mic. siltst. in sandst.	MIDDLE ECCA
│ UC 678 31,6	●	●				
│ SAP 6 1000'	●	●			Med. dark grey-dark grey siltst.	
│ SAP 6 1007'		●				
│ SAP 6 1007'6"	●	●				
│ SAP 6 1017'	●	●				
│ SAP 6 1019'		●				
UC 621 153'	●	●		c	Stringers of dark grey mic. siltst. in sandst.	
│ UC 678 78,9		●			Dark grey-greyish black thinly laminated mic. shale	
│ UC 678 79,0	●	●				
│ UC 678 79,3		●				
│ UC 678 80,6	●	●				
│ OW 1145'	●	●			Med. grey-med. dark grey siltst.	
│ OW 1148'	●	●				
│ OW 1156'		●				
HKr	●	●		b	Med. grey shale packed with leaf cuticles	
G172 117'	●				Med. dark grey-dark grey mic. silst.	
OW 1171'		●			Med. dark grey-dark grey siltst.	
│ P13 126,50	●	●			Med. dark grey-dark grey silty shale	
│ P13 128,13	●					
UC 678 108,6	●				Med. dark grey mic. silst.	
WV3 133,50	●	●			Dark grey mic. siltst.	
A 401 10,05	●			a	Med. dark grey siltst. with unrecog. woody fragments.	
A 401 30,85	●				Dark grey silty shale	
A 401 40,30	●				Med. grey mic. siltst.	
OW 1257'	●	●			Med. dark grey mic. siltst.	
UC 678 151,0	●				Med. dark grey-dark grey thinly laminated mic. shale	
P13 140,6	●				Med. dark grey mic. siltst.	
│ P13 146,8	●	●				
│ P13 147,7	●					
LA 5349'	●		2	d	Med. grey-med. dark grey mic. siltst.	LOWER ECCA
LA 5379'	●					
LA 5395'	●					
LA 5419'	●					
│ SAP 6 1130'	●	●		c	Greyish black carb. to coaly shales with unrecog. plant debris.	
│ SAP 6 1131'	●	●				
│ SAP 6 1133'	●	●				
│ P13 152,95	●			b	Dark grey carb. shale with coaly stringers.	
│ P13 153,39	●	●				
│ P13 154,35	●					
│ SAP 6 1151'3"	●	●		a	Dark grey highly carb. shales with numerous Lycopod megaspores + unrecog. plant debris	
│ SAP 6 1152'3"	●	●				
│ SAP 6 1152'9"	●	●				
UC 608 1262'	●	●	1		Med. dark grey-med. grey siltst.	DWYKA
UC 729 504,0	●				Med. dark grey siltst.	
│ UC 729 550,0	●					
│ UC 729 555,0		●				
│ UC 729 556,0		●				
UC 608 1590'	●	●			Dark grey-med. dark grey siltst.	

A total of 53 assemblages have been selected for detailed study.
10 of these include 30 sub-assemblages.
All these assemblages + sub-assemblages are listed above.

Key: │ brackets sub-assemblages of an assemblage.

● indicates assemblages or sub-assemblages from which % counts have been made or populations have been photographed.

adopted by Ian McLachlan, who has worked as palynologist at SOEKOR since early 1970, was followed. The two schemes are outlined in brief below:

Scheme adopted by Rodger Davey:

(a) *Preparation of sample*
(i) Clean sample of possible contaminants.
(ii) Crush ± 1,25 cm³ of sample in pestle and mortar.

(b) *Removal of carbonates*
(i) Add 5% HCl to sample in glass beaker.
(ii) Warm over steambath until reaction completed.
(iii) Wash, allow to settle and decant 4 times.

(c) *Removal of silicates*
(i) Add 40% HF to residue in metal beaker.
(ii) Warm over steambath for ± 3 days until residue a sludge.
(iii) Wash, allow to settle and decant 4 times.

(d) *Removal of dark organic matter* (oxidation)
Schultz solution treatment to loosen dark organic matter.
(i) Add Schultz solution to residue in glass beaker.
(ii) Warm over steambath for required time.
(iii) Wash, allow to settle and decant 4 times.

NH_4OH to release dark organic material.
(i) Add 10% NH_4OH to residue in stoppered buchner funnel.
(ii) Allow to react for 1 to 5 minutes.
(iii) Wash repeatedly through buchner funnel until free of fines.

(e) *Preparation of strew mounts*
(i) Mix residue with cellocise.
(ii) Spread solution on coverslip and allow to evaporate overnight.
(iii) Fix coverslip to slide using Canada Balsam.

Scheme adopted by Ian McLachlan:

(a) *Preparation of sample*
(i) Clean sample of possible contaminants.
(ii) Crush ±12 g of sample in pestle and mortar.

(b) *Removal of carbonates*
(i) Add 50 cm³ 5% HCl to sample in 250 cm³ metal beaker.
(ii) Warm on electric hotplate until reaction completed.
(iii) Centrifuge 3 times at 3 400 rpm in 50 cm³ polypropylene tubes.

(c) *Removal of silicates*
(i) Add 50 cm³ 40% HF to residue in 250 cm³ metal beaker.
(ii) Simmer on electric hotplate until residue a sludge.
(iii) Centrifuge 4 times at 3 400 rpm in 50 cm³ polypropylene tubes.

(d) *Removal of fluosilicates* (formed during treatment with HF)
(i) Add 50 cm³ 5% HCl to residue in 250 cm³ metal beaker.
(ii) Boil on electric hotplate for ± 10 minutes.
(iii) Centrifuge 4 times at 3 400 rpm in 50 cm³ polypropylene tubes.

(e) *Removal of insoluble minerals*
(i) Add $ZnCl_2$ solution (heavy liquid) to residue in 15 cm³ glass tube.
(ii) Place 241 mm flexible plastic tubing folded double in 50 cm³ centrifuge tube.
(iii) Pour solution into "U" tube, balancing both sides.
(iv) Centrifuge at 2 000 rpm for 20 minutes.
(v) Transfer light fraction to 15 cm³ glass tube.
(vi) Centrifuge 4 times at 3 000 rpm.

(f) *Removal of dark organic matter* (oxidation)
HNO_3 treatment to loosen dark organic matter.
(i) Add 10 cm³ 55% HNO_3 to residue in 50 cm³ polypropylene tube.
(ii) Warm in beaker of hot water for required time.
(iii) Centrifuge 4 times or until clear.
NH_4OH treatment to release dark organic matter.
(i) Add 10 cm³ 10% NH_4OH to residue in 15 cm³ glass tube.
(ii) Allow to react for 1 to 5 minutes.
(iii) Centrifuge 5 times or until clear.

(g) *Preparation of strew mounts*
(i) Mix residue with cellocise.
(ii) Spread solution on coverslip and allow to evaporate overnight.
(iii) Fix coverslip to slide using glycerine jelly.

A certain degree of adaptation to the requirements of each sample must be exercised in both schemes. The most significant variability occurs in the removal of carbonates and in oxidation.

(a) Most Karoo Permian samples contain no carbonates in which case the process for their removal is skipped.

(b) The HNO_3 or Schultz solution oxidation time required by each sample varies quite considerably. The time must be estimated in each case and the process closely checked. For Karoo Permian samples the oxidation time varies from nil to 48 hours or more.

Storage of material

The samples, spare residues, strew mounts (slides) and photographic negatives are all stored at BPI.

CHAPTER 3

Approach to systematics

3.1 INTRODUCTORY COMMENTS

The problems encountered in fossil miospore systematics are twofold, inherent and imposed. The inherent problems are those naturally attached to unravelling, from the preserved material, the complex story of plant evolution. The imposed problems are those introduced by the necessary adherence to traditionally accepted rules of procedure which, based on earlier investigations when less data and less sophisticated equipment and techniques were available, might no longer be altogether adequate.

Firstly, the inherent problems, which include consideration of the concepts of populations, species and speciation and the difficulties of their application in fossil miospore taxonomy, are discussed. Secondly, certain problems arising from the study of the Gondwana Permian literature and the application of the Rules of Botanical Nomenclature are discussed. These problems have been outlined in similar vein by various leading researchers who have offered proposals as to how they may be overcome. In particular the suggestions and working methods of Hughes and co-workers (1967 - 1973) are surveyed. The approach taken in the present work is then outlined, and is followed by a suggested future procedure aimed at attaining eventual taxonomic stability.

3.2 THE CONCEPTS OF POPULATIONS, SPECIES AND SPECIATION AND THE DIFFICULTIES INVOLVED IN THEIR APPLICATION IN FOSSIL MIOSPORE TAXONOMY

In order that the taxonomy of fossil miospores may reflect natural phyletic relationships where possible it is necessary to bear in mind the concepts of populations, species and speciation. Current thoughts on these concepts are briefly outlined.

Perhaps the most succinct and widely applied definition of the species in neontology is that of Ernst Mayr (1963): "A species is an array of populations which are actually or potentially interbreeding and which are reproductively isolated from other such arrays under natural conditions".

G.G. Simpson (1958) defined a population as: "..... a group of organisms similar among themselves and dissimilar from other organisms with which they live, descended from a not remote ancestor, living in the same general region and environment and with a continuity of many generations through time." It should be added in the case of a plant population that there exists a graded probability of cross-fertilisation which tends to become negligible between central and peripheral members. The range of variation exhibited by individuals within a population may be very variable. This variation is due to a combination of factors - stage of ontogenetic development, innate genetic differences and environmental influence.

Raup & Stanley (1971) define speciation and elaborate on the concept as follows: "Speciation is the evolutionary process of species formation. There are two types: phyletic speciation and geographic speciation. The first is the evolution of one species into another through time. Since by the process, one species replaces another in an 'evolutionary lineage', the total number of living species at any time is not affected by it. Geographic, or allopatric speciation, the process by which one species evolves into two or more contemporaneous species, leads to an increase in the total number of living species."

There exists diverse opinion as to the relative importance of these two types of speciation. Eldredge & Gould (1972) express the opinion that allopatric speciation is by far the more pervasive occurrence. They visualize that it is the small peripheral geographically isolated population of a species that is the most likely to undergo speciation. Such a population will occur in an environment relatively alien to the species, adaptive pressure thus being strong. In addition, the size of the population and its geographic isolation are such that genetic changes will spread rapidly and there will be little dilution through gene flow from adjacent populations. They feel that speciation under such conditions occurs relatively rapidly and that the transitional forms will rarely be preserved in the fossil record. Once a new lineage (species) has been thus established it undergoes no further significant evolutionary changes (other than in the case of further allopatric speciation). The lineage enjoys general homeostasis (morphological stability).

Important also in the discussion of species and speciation is the consideration of hybridization and the extent of its effect in blurring species boundaries. It is generally assumed through circumstantial evidence that the effect has been relatively slight. Raup & Stanley (1971) write for instance: "If biologic diversity is to be maintained, species must remain distinct. In biologic terms this means that hybridization between species must be uncommon."

The application of the population and species concepts in palaeopalynology presents many difficulties. How is it to be decided which group of fossil miospore specimens are representatives of a single natural population, or which group of populations are representative of a single natural species?

A sample of a population can theoretically be isolated from a number of rock samples scattered horizontally and vertically through a sedimentary deposit which accumulated in a restricted area and over a restricted period of time. A number of problems may occur. Firstly, the longer the duration of time represented by the deposit the greater the likelihood that the local flora will have altered to the extent of incorporating further populations that have invaded the area. Secondly, depending on the nature of the deposit and its palaeogeographic situation, the microfloral assemblage might include a greater or lesser influx of specimens representative of populations from further afield. It is well documented from microfloral studies of recent deposits that the extent of influx, depending on geographic situation, can be very variable.

Even in the event that the effect of the above two factors were negligible there remains the difficulty of assessing which group of specimens are actually representatives of a natural population. Do a number of specimens (from a single assemblage) which fall within a continuous variation field necessarily represent a single population?; or on the other hand if a distinctly bimodal or polymodal curve of variation is witnessed, is more than a single population necessarily indicated? In the first case, it is well known that in many extant genera, the miospores of certain species are indistinguishable (at least at light microscope level) from one another, or even that in some higher taxa the miospores of certain genera are indistinguishable. In the second case, particularly in the instance of known invertebrate populations bimodal or polymodal curves of variation are quite often encountered (Hallam, 1972).

The difficulties involved in species recognition are numerous. To what extent can they be naturally rather than arbitrarily defined? In extant floras, given a minimal degree of hybridization, species can generally be recognized as distinct entities. The complete plant is available for study, the geographic distribution of the various populations can be accurately plotted, and breeding experiments can be conducted. In palaeopalynology we are dealing only with the miospores, the geographic distribution of populations cannot be plotted nor can breeding experiments be carried out. Moreover the dimension of time, incorporating evolutionary development and continually changing patterns of colonization of populations and species, is involved.

If allopatric speciation followed by homeostatic lineages as envisaged by Eldredge & Gould (1972) were universal and if hybridization were indeed as rare as suggested by Raup & Stanley (1971) the objective recognition of species (lineages) should be relatively simple. However, if phyletic speciation played a significant role and if lineages were further complicated by a relatively high occurrence of hybridization, species delimitation would involve, to a far greater extent, arbitrary subjective decisions.

3.3 TAXONOMIC PROBLEMS RELATING TO THE GONDWANA PERMIAN LITERATURE

Brief comment on certain aspects of Gondwana Permian microfloral literature and systematics should lend perspective to various problems resulting from the necessity of consulting all earlier work within the framework of ICBN.

In Fig. 1 is indicated the rash of papers and described species that have appeared in recent years. Ninety per cent of the 253 available papers (see 4.5.a.) post-date 1955. By the end of 1974 (excluding unpublished works) 283 genera and 749 species had been described. Of these, 105 genera and 649 species were described as new whilst the remainder were adopted from other literature (i.e. from the Northern Hemisphere Permian or from older or younger strata of either hemisphere). Within the group of genera shown in the graph for instance, 289 species (257 as new) have been described, 232 of which were introduced in the brief spell of seven years between 1964 and 1970.

Considering the general similarity of microfloral assemblages encountered throughout Gondwanaland and that many of the taxonomic decisions were being made independently and simultaneously it is most likely that a high degree of duplication in naming occurred.

To achieve synonymy within the described material in a way that reflects natural species is highly problematic. Most Gondwana Permian palynological work completed to date has been directed towards local stratigraphic correlation. The taxonomy employed has been that judged most expedient for this purpose and has rarely been guided by a consideration of the concepts of natural populations, species and genera.

The majority of newly erected species are based on the generalized description of an array of uncatalogued specimens from unspecified assemblages and localities. The descriptions are most often accompanied by only one to three photographed specimens and, beyond the type specimen, rarely is their source noted. It cannot be accepted simply on faith that the specimens on which the original author based his diagnosis actually represent a single species (no matter what species concept was applied). The only readily available material for comparative study with a view to taxonomic revision by later authors remains the photographed specimens, and should

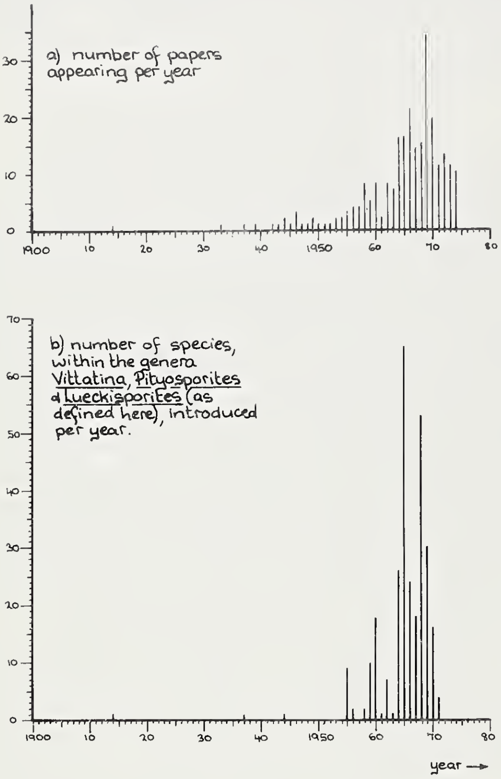


FIG. 1 - Graphs illustrating the proliferation of literature and species in Gondwana Permian palynology

be restricted solely to those with the relevant temporal data.

The next problem is the choice of stable generic and specific names according to the rules of priority. Unfortunately the rules as they presently stand are insufficiently explicit to cope with the upsurge of literature and new names as has been witnessed in Gondwana Permian palynology. The only guidelines available in the application of the priority ruling are date of effective and valid publication and page sequence if more than one relevant article occurs in a single edition of a particular journal or book. If one considers that in the year 1969 alone, 34 papers (mostly taxonomic) on Gondwana Permian palynology appeared, the scale of the problem can be appreciated. Assuming the output of 253 Gondwana Permian references were average for each hemisphere per geological system, the total number of papers on Devonian to Jurassic non-marine miospores would be approximately 2 500. Any comprehensive review of Gondwana Permian miospore nomenclature should take full account of at least this spread of literature. Until all the data is stored in a way suitable for computerized retrieval, this is not really feasible.

3.4 THE SYSTEMATIC APPROACH OF HUGHES AND CO-WORKERS (1967-1973)

Many authors have in recent years expressed alarm at the difficulties that have arisen regarding taxonomy in palaeopalynology, and various procedures for improved progress have been suggested. The most pervasive and fully substantiated proposals of which the author is aware, are those of Hughes and his colleagues (Hughes & Moody-Stuart, 1967a, b, 1969; Hughes, 1969, 1970a, b; Hughes & Croxton, 1973). An outline of their views and approach are given here as being pertinent to the present discussion on systematics.

Their proposals were made through a recognition of the failure of the traditional approach to palynological taxonomy to realize the inherent potential which the material obviously possesses in detailed stratigraphic correlations and the unravelling of plant evolution and geography. They feel that although miospores occur widely distributed and in great numbers the resolution of correlation attained in palynological research has shown no improvement over the results obtained through the studies of far less abundant fossil groups. This resolution is of the order of a stratigraphic stage, that is of about 5 million years, in the case of Cretaceous strata in which their studies have been undertaken. From the work they have completed, following their new scheme, they concluded that correlations could theoretically be refined down to the limits of 'rock sampling'. They suggest that the failure in palynology is primarily due to the rigid adherence to the rules of ICBN which were introduced and adapted to the needs of extant botanical studies, but which are not suitable for the study of pre-Tertiary material. They feel in addition that the rules allow far too great a flexibility through subjectivism which has resulted in the complete instability in the application of genera and species. Without a stable communication medium devoid of ambiguity palynology fails as an eminently useful tool.

The great majority of past palynological research and indeed of all fields of palaeontology, has been devoted to the study of isolated specimens scattered through time and space, rather than to the study of population dynamics now receiving attention in studies of extant biological material. The very numerous literature and man-hours devoted to the laborious and unrewarding attempts at unravelling past literature in the pursuit of priority, typology and synonymy according to the rules of nomenclature retard progress.

The whole emphasis of Hughes and his colleagues has thus been devoted to the formulation and adoption of a system of study which allows for a fully productive use of the available time and manpower according to the knowledge, techniques and devices presently at hand. They avoid the application of the traditional Linnean binomial system and its adherent rules and introduce a utilitarian system fully suitable to unambiguous data storage and retrieval which is useful not only to the specialist palynologist but to geologists and biologists in general. Their system incorporates the study of populations and recognizes their continuous variability through space and time.

They introduce the terms biorecord and genusbox, which concepts are in scope essentially equivalent to the species and genus respectively, but which are employed to avoid confusion with the Linnean system and to dispense with the obligation of following the rules of botanical nomenclature.

Hughes & Moody-Stuart (1969, p.86) define the biorecord as "a conceptual taxon, based on specimens from one sample or locality that are judged to have a normal distribution of continuous variation. A palynological biorecord has a basis in not less than 100 topotype specimens. Should a biorecord prove unsatisfactory in use it can be replaced without formality by another from the same or another sample; it can also overlap the variation of another to any degree. There is no question of priority, only of use or discard; each biorecord bears a unique author's serial number". The biorecord coincides roughly with the scope of a species as applied in the taxonomy of extant material. It is regarded as the fundamental reference taxon and is accorded the unique coded title (rather than a specific epithet as in the binomial system) for use in communication and in a data storage and retrieval system. The type specimen is regarded as redundant.

The description of a biorecord includes in essence photographic representation of about 10 specimens (selected to illustrate the material in its various aspects) falling within the middle ground of the normal range of variation. The observed range is indicated by brief descriptive text and biometric data. Also recorded are the locality, stratigraphic horizon, sample description, percentages of associated miospore types, and notes on preservation and sample preparation.

The genusbox is distinguished as a taxon for filing related or apparently related biorecords. It should embrace as closely as possible the scope of an extant genus. Hughes (1969) feels that general knowledge of pre-Tertiary dispersed miospores has reached a stage where few major morphographic surprises are likely. He therefore suggests that more or less arbitrary mutual morphographic and time limits between adjacent genusboxes can at the present time be defined. He admits that further modifications might become necessary in some cases but that full stability could be achieved where the material is adequately understood in a morphological sense. The type species is regarded as redundant. The genusbox is accorded a unique code title, and not a classical name as in the Linnean system.

3.5 GENERAL OUTLINE OF APPROACH FOLLOWED IN PRESENT INVESTIGATION

The approach of Hughes and co-workers sidesteps ICBN completely in that the delineation of species, and the application of binomial nomenclature, priority and typology are all avoided. Their immediate purpose was fine resolution in local stratigraphic correlation which based no reliance on the determination of species. The aims of the present work are different in that besides the application in stratigraphic correlation, the investigation has been designed to provide an introductory understanding of the evolving picture of the full suite of preserved microfloras (not restricted to well represented biorecords as in Hughes *et. al.*) in the northern Karoo Permian in particular and in the Gondwana Permian in general. For this purpose it has been necessary to define species and to apply binomial nomenclature. The Linnean system readily facilitates communication of data regarding phylogeny, diversification, dispersal and other aspects of the microflora.

The approach followed in distinguishing, describing and naming 'populations', species and genera is outlined below.

'Populations'

An attempt has been made to photographically document all the miospore forms encountered in the 53 selected northern Karoo assemblages. The best preserved and most fully represented 'populations' for each form have been thus documented. In the case of the rarest miospore types a 'population' may include only 1, 2 or 3 specimens, but most are far more adequately covered (see 4.6). A 'population' is derived from a single assemblage. The set of specimens taken to be representative of a single breeding population (gamodeme) are those subjectively judged, based on all available morphological features, to fall within a continuous variation field. Where distinctly bimodal or polymodal variation curves are judged to occur, two or more populations are recognized. A case in point is the group of populations representing the genus *Vestigisporites* from assemblage HKr (see 5.4.3). 'Populations' have been illustrated where possible by as many specimens as judged necessary to adequately indicate the range of natural variation encountered, as well as to depict an array of specimens in different aspect and states of preservation.

A total of 250 'populations' has been documented.

Species

(a) In view of the present confused state of Gondwana Permian miospore taxonomy (see 3.3) the 250 'populations' were arranged into specific taxa independent of earlier conclusions. These taxa were delineated with regard to the following considerations. Within a broad group of related 'populations' (those presumed to fall within the compass of a single genus) the degree of morphological overlap may vary considerably. For the purpose of defining species, four grades of overlap - none, slight, intermediate, extensive - between adjacent 'populations' were recognized. 'Populations' with no or slight overlap were taken to represent separate species. Two or more adjacent 'populations' with intermediate overlap were split in the most convenient manner into two or more species. Adjacent 'populations' with extensive to complete overlap were considered conspecific.

An examination of certain 'populations' and species included here within the genus *Microbaculispora* will serve to illustrate the approach.

The 'reference population' of *M. pseudoreticulata* (51) (pl. 56) does not overlap to any extent that of the most closely related species, *M. naumovae* (52) (pl. 57), and is recognized therefore as a distinct species.

The 'reference populations' of *M. naumovae* (52) and *M. irregularis* (54) (pls. 57, 58) display a slight degree of overlap in that certain peripheral members of the two populations are morphologically inseparable. The available 'representative populations' of these two forms indicate no more extensive degree of overlap. The two species are thus recognized as distinct.

The morphological complex divided in the present work into the species *M. microreticulata*(37), *M. directa* (40), *M. plicata* (39) and *M. virkkiae* (38) (pls. 44 to 47) illustrates the approach followed where related 'populations' show intermediate degrees of morphological overlap (see Fig. 2). The relevant 'population' from SAP 6 1130' includes all four forms within a continuous variation field; that from UC 675 31,6/30,6 includes the last three forms within a continuous variation field; whilst that from UC 621 153' includes only the last two forms; SAP 6 1133' includes *M. plicata* (39) as a distinct species; whilst SAP 6 1152'9"/1151'3" includes *M. virkkiae* (38) as a distinct species.

Considering the set of 'populations' documented here the complex can be most conveniently split in the manner suggested. With a more extensive documentation of populations from many assemblages further species (e.g. *M. tentula* (41), *M. finegranulata* (42), *M. mediogranulata* (43) and *M. grandegranulata (44))* would very probably be included in the complex and a different separation of species might prove more appropriate.

Related 'populations' displaying more or less complete overlap, and therefore recognized here as a single distinct species may be illustrated by the four documented 'populations' of *M. lageniformis* (56) (pl. 59).

(b) With the Karoo Permian species thus delineated, a comprehensive appraisal of the photographically illustrated Gondwana Permian miospores (i.e. from the 253 available references) was made. Each illustrated specimen appearing in the literature was compared with the prepared catalogue of 'populations'. Each specimen considered subjectively to fall within or particularly near the variation field of a Karoo Permian species, was included within the hypodigm for that species. The great majority of specimens could be accommodated in this way in one or other of the 133 Karoo species. The remaining specimens were clustered subjectively into further species such that the morphological range exhibited was not greater than the average found in any Karoo species.

(c) The best preserved and most adequately represented 'population' available for each Karoo species has been nominated as the 'reference population' (in only four cases was it possible to nominate 'populations' from the literature). The geographic locality and stratigraphic horizon of the 'reference population' is given. The holotype and type locality (plus stratigraphic horizon) for previously named species are noted where available. For species newly named here a holotype (with type locality and horizon) is nominated.

(d) The description of the 'species' is based solely on the 'reference population' and emphasizes only those contrasting characteristics most pertinent in distinguishing the species included in any particular genus. The photomicrographs illustrate the full range of variation encountered. (For details see 4.4 and 4.6).

(e) The application of specific names has been based solely on the published Gondwana Permian references. The names were selected, from those originally applied to the specimens within a hypodigm for a particular species, according to the rules of priority. (For details see 4.5.c).

Genera

(a) Genera have been taken to include a cluster of obviously or apparently closely related species. In most genera a good proportion of the species form a "multiple assemblage morphological continuum" (MAMC). The additional species included in any particular genus are those considered subjectively to be insufficiently distinct from the continuum to merit inclusion elsewhere.

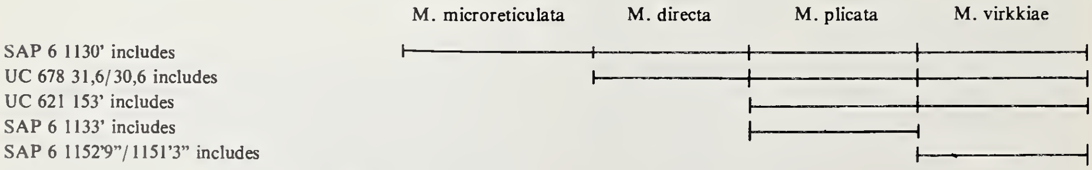


FIG. 2 - Schematic representation of overlapping populations of *Microbaculispora* from five assemblages

(b) The generic description includes two categories of morphological features. Firstly, those which remain constant for the genus, and on which its recognition is thus based; and secondly, those which vary within the genus and on which the division into species is based. (For details see 4.3).

(c) The application of generic names has been based solely on the published Gondwana Permian references. The names were selected according to the rules of priority. (For details see 4.5.c).

Supra-generic taxa

The 33 genera described in the present investigation, together with the additional 17 genera recorded elsewhere in the Gondwana Permian, have been grouped into five broad plant categories according to supposed botanical affinities. (For details see Chapter 5). No intermediate supra-generic taxa have been employed.

3.6 A SUGGESTED PROCEDURE TOWARDS ACHIEVING TAXONOMIC STABILITY

The taxonomic approach followed in the present work is seen as an interim measure. For reasons indicated in 3.2 and 3.3 it is felt that a stable taxonomic scheme can be achieved only through internationally co-ordinated effort according to a standardized procedure which need necessarily be substantially modified and more explicit than are the ICBN rulings at present. Suggestions for a possible procedure towards achieving eventual taxonomic stability are outlined below. The proposals regarding 'populations' are essentially similar to those of Hughes and co-workers (1967-1973) whilst those relating to species and genera follow different lines.

'Populations'

(a) As many 'populations' (perhaps palaeodemes or biorecords would be more appropriate terms) as possible should be accurately recorded and stored for ready reference by all researchers.

(b) 'Populations' should consist of numerous well preserved specimens falling within a continuous variation field. Biometric methods, rather than subjective assessment, should be employed. A 'population' should be derived from a set of samples representing a single assemblage from a discreet lithological unit (lithosome).

Consideration of the geographic setting in which the lithological unit was deposited, is important, since it is necessary to study assemblages in which the effect of contamination by specimens from different breeding communities further afield should be reduced to a minimum. Thus a unit deposited in an isolated coal swamp or small lake out of the line of strong prevailing winds would be more suitable than a delta front or pro-delta deposit which is situated at the mouth of a large river system and which lies in the course of strong ocean currents and prevailing winds.

(c) The accurate recording of 'populations' should include:

Sample data including the precise position of the locality and the depth in a borehole or horizon in a stratigraphic section; a succinct description of the samples and lithological unit from which they derive, together with an assessment of the geographic setting in which the unit was deposited.

Good photographic illustrations (at a standard magnification, preferably 500 or 1 000 X) of as wide a scatter of the population as possible, including abnormalities and specimens showing different aspects and different states of preservation. Between 25 and 50 photographed specimens would probably constitute an optimum.

Brief descriptive text and pen sketches only where necessary to elucidate certain points which may not be clear from the photographs.

Biometric data recording the variation field of important parameters.

Species

(a) Only once a large number of 'populations' of widely scattered stratigraphic age and geographic location are available for reference could species that are likely to enjoy stability be delimited. It would aid the task significantly if, in support, 'populations' of the other organs (e.g. leaves, fruits, seeds, etc.) of the parent plants were similarly available, particularly if they were derived from the same lithological units.

(b) With the wealth of 'populations' in hand and with their natural phyletic relationships considered it is probable that the full spectrum from simple homeostatic through to broad plexiform lineages will emerge. Considering the results of the present study it would appear that, for the Gondwana Permian, the latter category will be more in evidence. Homeostatic lineages can be simply defined as species, but the plexiform lineages present a difficult problem. Within these complex lineages, geographic and stratigraphic distribution will aid in species recognition, but the delimitation will probably have to be based to a large extent, on arbitrarily chosen mutual boundaries within fields of continuous morphological variation. The scope of variation included in a species would be consistent with that of extant species as far as possible. Frequently the situation will arise where populations scattered around the periphery of the species will be split in varying degree to fall partially within two or more closely related species.

(c) 'Reference populations' could now be chosen which fall somewhere within the middle ground of the species. 'Simple' rather than 'split populations' should preferably be chosen. These need not adhere to the rules of priority and would not hold secure tenure. They could be replaced by a different 'population' were the limits of the species to be redefined, or at any stage by a more fully documented 'population'.

(d) The species would be named according to the Linnean binomial system, but these names would be applied according to a set of rules more explicit than presently available in ICBN.

(e) With all the species thus defined and named, relative percentage counts of those present in the original assemblages could be made. This data could be appended to the relevant documentation of the 'populations'.

Genera

(a) With a relatively comprehensive set of stable species thus defined, the GSAD pattern of each could be plotted. Taking these patterns into full account, charts depicting the phylogenetic relationships of the species could be compiled. The reliability of these charts will depend in large measure on the accuracy and resolution of international stratigraphic correlations at the time.

(b) Genera which could be expected to enjoy stability could now be defined according to the evident phyletic relationships of species. The scope of a genus would be that employed within related extant plant groups.

(c) The genera would be named, as are the species, according to the Linnean binomial system.

Supra-generic taxa

It might be hoped that with time and detailed studies the parent plants of many of the genera will be known. It would be most valuable if, where possible, a common supra-generic taxonomic scheme were employed for both macrofloras and microfloras.

Notes on compilation and presentation of microfloral data

4.1 NOTES ON CHART 3: KAROO PERMIAN MIOSPORES; COUNTS PER ASSEMBLAGE

Percentage counts per species of 52 of the 53 assemblages studied are included in the chart. The 53rd assemblage (i.e. OW 1171'), which is represented in the photographic catalogue, does not appear since it was studied after Charts 3 and 4 were compiled and drafted. Ten of the assemblages are further divided into between 2 and 5 (average 3) sub-assemblages. For 9 of these assemblages separate counts, of either 2 or 3 of the sub-assemblages, are recorded.

The 52 assemblages (including the sub-assemblages) are listed in stratigraphic order to the right of the chart. The collection number of each strew slide counted and the quality of the disaccates encountered in each are recorded. The microfloral zones and sub-zones and the stratigraphic units to which the assemblages pertain are indicated.

The species list is arranged in natural sequence (as on Chart 4, in the 'photographic catalogue' and the 'species pages').

The approach followed in establishing percentage abundance per species requires explanation. The quality and quantity of specimens yielded in each assemblage varied quite considerably such that no single consistent system of counting could be followed. A number of slides (strew mounts) representative of a particular assemblage were traversed and the species listed. A good representative slide for the assemblage was then selected and as far as possible 200 or 300 specimens counted and the percentage abundance calculated. For those species where the abundance was less than 1% the full slide was re-traversed and an actual count of the number of specimens encountered was made. In particularly good slides some 10 000 miospore specimens occur. In such slides a species constituting 1% of the assemblage would be represented by 100 specimens, whilst a species constituting 0,01% would be represented by one specimen. In assemblages with a poor yield of specimens the results could be adjusted accordingly. In all cases percentages lower than 1% have been rounded off to 0,01%; 0,02%; 0,05%; 0,10%; 0,20% or 0,50%. In the best slides these smaller percentages will be more or less reliable whilst in the poorer yielding slides they represent rough estimates. Thus in certain poorer assemblages it will be noted for instance that many species are listed as all occupying say 0,10% of the assemblage.

In many of the assemblages the quality of the disaccates is poor or very poor. This makes their identification very difficult and the following scheme for estimating their percentages has been adopted:

(a) *Pityosporites triassicus* (111), *P. tenuicorpus* (114) and *P. micros* (122)

(i) Between assemblages OW 159' and SAP 6 991' (inclusive): The three species have been taken to be represented in equal proportions per assemblage, and the three together to comprise ± 1/5 of the full count for *Pityosporites*.

(ii) Between assemblages UC 678 31,6/30,6 and LA 5419' (exclusive of those assemblages with a disaccate quality of f-g or g): The three species have been taken to be represented in equal proportions per assemblage and the three together to comprise ± 1/15 of the full count for *Pityosporites*. This follows roughly the average of the patterns exhibited in assemblages OW 1148'/1145' and HKr, the only two cases within the group in which the disaccate quality is good. For those assemblages with f-g or g disaccate quality a direct count has been made.

In the above two groups of assemblages (i) and (ii), where the 1/5 or 1/15 proportions of the total *Pityosporites* count was not evenly divisible into three, the first odd count was always allotted to *P. triassicus* (111) and the second to *P. tenuicorpus* (114):

(iii) Below assemblage LA 5419' there is no evidence of either *P. tenuicorpus* (114) or *P. micros* (122) occurring. For *P. triassicus* (111) an attempt to make a reasonable direct count per assemblage was made.

(b) *Pityosporites goraiensis (119), P. ovatus (115), P. maximus (116).*

P. goraiensis (119), with its finely etched striae can only be recognized in assemblages with good disaccate quality. Only four such assemblages (or sub-assemblages) occur in all those counted. In other cases it is mostly indistinguishable from the non-striate *P. ovatus* (115) and *P. maximus* (116). The approximate proportions of visibly striated to non-striated forms in the four good assemblages are given in Table 5. Only the best preserved specimens were counted.

TABLE 5 - Approximate proportions (expressed as percentages) of striate to non-striate forms

	P. ovatus (115) + *P. maximus* (116)	*P. goraiensis* (119)
Kb	20	80
OW 94'	90	10
OW 1145'	90	10
HKr	100	0

The three assemblages above OW 94' were taken to yield the same proportions as in Kb; all those between OW 94' and OW 1145' have been taken to yield a 90:10 proportion; all those below HKr to yield a 100:0 proportion. It is quite possible that some assemblages below HKr do have striated forms but none have been recognized.

(c) The remaining *Pityosporites* species

For the remaining *Pityosporites* species direct counts have been attempted.

(d) *Lueckisporites asulcus* (124) and *L. nyakapendensis* (125)

In the group of assemblages OW 159' to SAP 6991' only the rare reasonably well preserved specimens of these two species can be distinguished from one another. Throughout this group of assemblages the two species are taken as occurring in equal proportions. In all other assemblages direct counts have been made.

4.2 NOTES ON CHART 4 : KAROO PERMIAN MIOSPORES; SAD PATTERNS

Chart 4 graphically illustrates the data gathered during the present research programme regarding the SAD pattern of each miospore species in the northern Karoo Permian.

The 33 genera and 133 species are arranged and classified as far as possible in natural sequence, with the most closely related forms included adjacent to one another. The probable and possible phylogenetic relationships indicated are based solely on the study of Gondwana Permian data. They indicate the subjective impressions of the author as regards the degree of morphological similarity or dissimilarity between the various defined species and genera. Rigorous multi-parameter statistical comparisons have not been attempted. The lineages are all included on the chart as if depicting rapid evolution from a peripheral population followed by a long period of homeostasis. As pointed out in 3.6 however, it is envisaged that in many genera, over long periods of geological time, certain groups of species must have participated together as highly plexiform lineages. Gene flow between populations of a single species and between species appears to have been common. The phyletic links are thus presented in highly simplified form. The earliest recorded point in time at which a species makes its appearance in Gondwanaland (based on the data on the 'species pages') is indicated as a node in the phylogenetic tree.

Quite obviously a comprehensive study of the data available for the Permian of the Northern Hemisphere and the Carboniferous of both hemispheres would necessitate certain changes to the relationships and of nodes of origin suggested here. These additional studies have not been undertaken. Only in the case of *Vestigisporites*, based on data discussed in Anderson (1973, p. 68-70), have the lines indicating derivation been extended below the base of the Permian.

The vertical time scale and the Permian reference stages and substages are as in Chart 1. The northern Karoo stratigraphic units and the microfloral zonation scheme are discussed in 6.1. The scale adopted for the percentage abundance graphs for each species is indicated in the key to the present chart. For purposes of simplification the abundance of a species is included as being consistent through any particular microfloral stage. The abundance indicated is the average for the species in the relevant assemblages.

4.3 NOTES ON CHAPTER 5: SYSTEMATIC ACCOUNT OF GENERA

The 33 miospore genera described from the Karoo Permian have been grouped according to their supposed botanical affinities into five broad parent plant categories:

Acritarcha (including unicellular algae and possibly some fungi and other non-vascular plants).
Lycophyta.
Sphenophyta and Filicophyta (including possibly some Algae, Bryophyta, Lycophyta and Pteridospermophyta).
Glossopteridophyta (including possibly some Pteridospermophyta, Coniferophyta and other gymnosperms).
Coniferophyta, Cycadophyta, Ginkgophyta (including possibly other gymnosperms or non-gymnosperms).

The group of genera included in each of these categories is dealt with separately and is discussed and described as outlined under each of the following headings:

(a) Revised list of Gondwana Permian genera and species

The list (see Tables 8-12) includes all recorded genera and species as recognized in the present paper, from the Gondwana Permian. Excluded are those species which make their first appearance in the uppermost Permian and are more Triassic in aspect (see 6.4).

The northern Karoo species are numbered 1 to 133 (referring to their 'species page' numbers).

The hypodigm for these species can be found on the relevant 'species page'. For those species not recorded from the northern Karoo the hypodigm is appended to the present list, and for each a 'reference-population' is nominated by inclusion in italics and underlining.

(b) Botanical affinities

A brief summary of the available information concerning the botanical affinities of the genera included in the group is given. This information is as yet far from adequate, hence the parent plant categories employed are very broad, and even then certain of the genera are likely to have been misplaced.

(c) Generic distinctions

The principal morphological features distinguishing the Karoo genera are discussed. Where certain genera appear particularly closely related, the features suggesting this are noted. The supposed phylogenetic relationships between the genera are depicted on Chart 4.

(d) Specific relationships

Each northern Karoo genus with its included species is discussed in turn with respect to the number of species and populations recorded and the degree of relationship between the species. Details concerning the populations available per species and assemblage are given in Chart 5, Appendix 9.5

(e) Generic descriptions

The generic descriptions have been rendered in brief paraphrase according to a consistent layout to facilitate ease of comparison. They are based solely on the 'reference populations' of the species from the Gondwana Permian considered to fall within the genus.

Two different categories of characteristics are described for each genus: those which remain constant for all the species within the genus and those which vary within the genus and on which the delimitation into species is based. In the latter category the range of variation is normally indicated by reiterating the descriptions as given for each of the included species.

For the genera *Vittatina, Pityosporites* and *Lueckisporites* pen sketches (Fig. 5 - 7) of the Karoo Permian species have been included to supplement the descriptions. In the case of *Pityosporites* the sketches are schematic and illustrate that set of characters on which the species are distinguished. In the case of *Vittatina* and *Lueckisporites* the sketches represent reconstructions of the undistorted, fully expanded miospore. In all three genera the sketches represent the idealized norm of the 'reference population' for each particular species. This idealized norm constitutes an assembly of the mean of each described character.

4.4 NOTES ON APPENDIX 9.3: SPECIES PAGES

A 'species page' has been prepared for each of the 133 northern Karoo Permian species. The species are arranged in presumed natural sequence and are numbered 1 to 133. This numbering system is used throughout the work; wherever a species is listed or mentioned the relevant number is noted alongside. Each 'species page' includes a standard set of data : generic and specific title, reference population and reference locality, holotype and type locality, closely related species, the hypodigm for the species (under the heading 'references') and a map and chart indicating the known Gondwana Permian GSAD pattern.

(a) Generic and specific title

The derivation of the binomial is explained in 4.5. In all instances where a new name combination has been proposed the original binomial pairing is included beneath in smaller type. For a full list of basionyms, authors and original references see 8.2.

(b) Reference population

The reference population represents the best available photographically illustrated population for the species in question. In only four cases, *Mehlisphaeridium fibratum* (4), *Circulisporites venosus* (9), *Quadrisporites horridus* (17), and *Pityosporites nectus* (110), has it been possible to nominate as reference, populations other than those illustrated in this study.

(c) Holotype

A holotype and type locality are designated for all new species and cited for all earlier species where they have been previously designated.

(d) Name derivation

The name derivation is included for interest and as a mnemonic. L. and Gr. are abbreviations for Latin and Greek. The phrase in brackets indicates the characteristic to which the name refers.

(e) Description

The description of the species is based solely on the 'reference population'. This is a provisional expedient in view of discussion under 3.6. Stable mutual boundaries between species cannot be defined at the present time. New species are described according to the same format as established species. Only those features significant in contrasting the species included in any particular genus are noted, whilst those common to all the species of the genus are described under the relevant generic description.

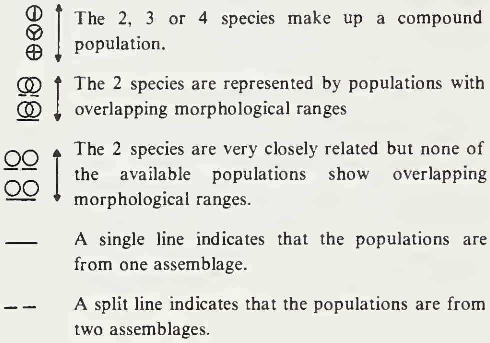
The overall size measurements given are those of the maximum diameter of complete undistorted specimens as seen in polar view. Obvious monstrosities are excluded from consideration. The two outer figures represent the extremes in the population, whilst the bracketed centre figure represents in most cases their arithmetic mean, this usually approximating the norm. In cases where the arithmetic mean quite obviously does not represent the norm of the population this norm has been estimated and included instead.

For the other characteristics described, usually only the norm for the population is considered, the photographic illustrations providing indication of the spread of variation.

The photographic coverage of miospore populations is regarded here as playing an important role in species descriptions, hence the extensive catalogue.

(f) Closely related species

The aim here is to list those species which are most closely related to the particular species under discussion. The degree of relationship is indicated by the symbols shown in Fig. 3.



The 2, 3 or 4 species make up a compound population.

The 2 species are represented by populations with overlapping morphological ranges

The 2 species are very closely related but none of the available populations show overlapping morphological ranges.

A single line indicates that the populations are from one assemblage.

A split line indicates that the populations are from two assemblages.

FIG. 3 - Symbolic representation of degrees of relationship of populations

To the right of each listed symbol is noted the plate and figure number(s) of the representative(s) of the two or more species under consideration. The first entry in each case represents the species being dealt with on the particular 'species page', whilst the second represents the species listed to the left of the symbol. In the case of compound populations the full split population for each species is noted. In the case of overlapping populations the specimens or groups of specimens occupying the overlap are noted. In the case of closely related species with no overlap the most closely similar specimens of each population are noted.

(g) Literature

Under the heading literature is included the full Gondwana Permian hypodigm (according to the review undertaken here) for the species. No attempt to append a fully elaborated synonymy list is made. In many cases this would become exhaustively long and would be primarily of historical interest. Instead, every photographically illustrated specimen which is considered referable to the species has been noted.

The majority of the photographically illustrated material in the literature consists of individual specimens from separate or unspecified samples. The majority of these specimens fall within or very close to the morphological limits of one or other of the 'reference populations' introduced in this paper and are included in the species for which that population is taken as reference.

Some of the illustrated specimens that have been included are very poor, liable to misinterpretation, and have possibly been assigned to the incorrect species. Notable examples of easily confused species under such circumstances are *Cycadopites cymbatus* (129) with *Vittatina triradiata* (109); various species of *Cyclogranisporites* with one another or with *Partimtactosporites verrucosus* (80); various species of *Pityosporites* with one another; and *Microbaculispora directa* (40) with *M. tentula* (41). In the last example where it was not possible to decide from the illustration whether the specimen was *M. directa* (40) or *M. tentula* (41), it was included on both 'species pages'.

In view of taxonomic instability, species simply listed are ignored, except in those relatively few instances (e.g. *Circulisporites parvus* de Jers. and *Laevigatosporites vulgaris* Ibrahim), where it is possible to be reasonably confident of their connotation. Such references are bracketed.

The work of Evans (1964a, c, 1966a, b, c, 1967a) all on Queensland material, and Evans (1967a, b) on Sydney Basin material, are taken as units when noting references of listed material.

The entries are ordered as in the annotated bibliography.

(h) GSAD pattern for the Gondwana Permian

For a detailed key to the distribution map and stratigraphic table see Appendix 9.3. A graphic plot of the presently recorded GSAD pattern for the species in question for the Gondwana Permian is given. The data are based solely on the references cited. The patterns that presently emerge are subject to considerable improvement with forthcoming information (see 6.3).

4.5 NOTES ON APPENDIX 9.4: ANNOTATED BIBLIOGRAPHY

The Gondwana Permian palynological bibliography is arranged and annotated in the form presented for a number of reasons. Beyond providing an up-dated comprehensive coverage of the available references, it renders a simple account of the geographic and stratigraphic extent of the work done to date and facilitates nomenclature according to the rules of priority.

(a) Comprehensiveness and number of entries

An attempt has been made to provide a comprehensive coverage of the references (253 to date, see Fig. 1) relating to Gondwana Permian palynology. To accomplish this fully is not, however, practical and the following categories of literature have been omitted.

(i) Papers on other fields of geology and palaeontology which include general or brief mention of some aspect of Gondwana Permian palynology, but which include no assemblage lists or photographs.
(ii) Papers which appear late in the history of the literature for any particular area, but which include no new data or interpretation of data.
(iii) Unpublished theses or reports whose data are superceded or are more readily available in other references.
(iv) Unavailable reports (e.g. those of mining and oil companies).

(b) General layout

The bibliography comprises a key map (map 2), two index tables and the 253 annotated references.

(i) *Map 2* includes the known distribution of outcrop and subsurface Permian strata of Gondwanaland. The continents are arranged only roughly according to their position during the Permian. No exact fits have been attempted.

As far as possible all the localities (surface, colliery and borehole) from which assemblages have been either described or listed are indicated. In certain cases (mentioned on the map) some of the localities have been either excluded or taken together to represent a secondary region.

Each continent has been sub-divided into a number of primary regions which are numbered 1 to 23 (for the whole of Gondwanaland) in clockwise order. Each primary region has been further sub-divided into secondary regions which are numbered A to Z (for each primary region) in W to E., N to S or clockwise order. A total of 81 secondary regions have been demarcated. Each of the primary and secondary regions have been appropriately named.

(ii) *Index 1* 'Alphabetical list of references (according to author)'.

The aim of this index is to provide ease of reference from any article cited on the 'species pages' or elsewhere to its annotated bibliographical entry(s). The authors' names are abbreviated as on the 'species pages' and the photographic plates. The right hand column indicates the primary and secondary regions under which the article appears in the annotated bibliography.

(iii) *Index 2* 'Chronological list of references'

The primary function of this index is to list all 253 references in chronological order according to a set of principles (proposed below) for establishing priority of effective publication. This list is referred to when establishing nomenclatural (generic and specific) priorities. A further function is that it indicates clearly the annual output of relevant literature.

(iv) *The 253 annotated references*

The 253 references are ordered according to the primary and secondary regions to which they pertain. In the case of India, due to the large number of papers available, the references are further sorted into tertiary regions (e.g. coalfields). All regions are numbered and named as on Map 2.

References which include descriptions of miospores from more than one primary, secondary or tertiary region, are repeated under the different relevant regions. They are in addition included under the heading 'general', ('general' may pertain to a particular primary region, continent or to Gondwanaland as a whole). Also under the various ranks of heading 'general' are included articles concerned purely with generalized aspects of the palynology.

A concise standardized summary of the contents of each reference is given. In papers which include information additional to that pertaining to the Permian, only the Permian data are considered. For descriptive papers the summary includes:

Number of samples, lithology of samples.
Number of localities (borehole, colliery or surface), area(s) in which these occur.
Number of genera and species listed or described (with number of new names erected).
Absolute, relative or percentage abundance data.
Number of photographic plates and figures, number of species descriptions.
('?' indicates that the data cannot be ascertained from the reference. The phrase "3(6) samples" indicates that six samples were prepared, but only three contained miospore assemblages which were examined.)

Papers appearing early in the history of literature for any particular area, which include only limited data that has subsequently been fully superceded are included simply according to author and date (i.e. with no title, journal, publishers or annotation). Reference to a bibliography in which it appears is made.

Papers concerning the same sample or set of samples (or part thereof), by the same or different author(s), are regarded here as sequels and bracketed together (down the left hand margin of the summary of contents).

In the left column is indicated the stratigraphic age (local terminology) of the material described in each article. Below it (in brackets) is provided the Karoo Basin equivalent. In the case of India, for each coalfield, the articles are ordered according to stratigraphic age of the material described, youngest above and oldest below.

Periodical abbreviations are based, where possible, on the "World List of Scientific Periodicals, 1900 - 1960", 4th edition, ed. Brown, P. and Stratton, G.B. For the several symposium volumes the author followed his own standard format of reference. It has been considered unnecessary to include the publishers or editors of these latter volumes.

(c) The choice of generic and specific names

The problems relating to the taxonomy and nomenclature of Gondwana Permian miospores are discussed in 3.3. The application of generic and specific names in the present work is based solely on the Gondwana Permian literature. Inevitably, for those miospores (including forms herein described as new) which are not confined to the Permian of Gondwanaland, future name changes will be necessitated. The names are applied according to priority of effective publication, the latest rulings (ICBN Seattle, 1969) being:

> *Art. 29:* "Publication is effected..... only by the distribution of printed matter .... to the general public or at least to botanical institutions with libraries accessible to botanists generally ....."
>
> *Art. 30:* "The date of effective publication is the date on which the printed matter became available as defined in Art. 29. In the absence of proof establishing some other date, the one appearing in the printed matter must be accepted as correct."
>
> *Recommendation 3a:* "The date on which the publisher or his agents delivers printed matter to one of the usual carriers for distribution to the public should be accepted as its date of publication."

The task is to place the 253 relevant references in chronological order based on their effective dates of publication. Two problems arise which render this task only partially possible. First that most publications do not carry the necessary information regarding the effective date of publication and secondly that insufficient rules are available for dealing with such cases. The following scheme for ordering the references has therefore been devised and applied:

(i) Priority according to date (month and/or year) of effective publication.

(ii) An article for which the month and year of effective publication is available gains priority over same where only the year is available.

(iii) Page priority where more than one relevant article (referred to below as a 'set') appears in a single publication. (N.B. if more than one volume of a particular journal carries the same date of effective publication, article(s) in the lower numbered volume obviously gain priority).

(iv) Author alphabetical priority where more than one article carries the same date of effective publication.

(v) Author alphabetical priority according to the first article of a 'set' where more than one 'set' carries the same date of effective publication, or where a 'set' competes with an individual article(s) of the same date. (A 'set' is always ordered in an unbroken sequence, and bracketed together as such in the 'chronological list of references').

(vi) An individual article or a 'set' appearing in a symposium volume (where the date on which it was held is given) gains priority over same appearing in a journal or book of the same date of effective publication. (The argument here being that the information was at least available for perusal at an earlier date).

(vii) Journal alphabetical priority is applied where more than one paper by the same author appears in different journals (etc.) carrying the same date of effective publication.

(viii) Unpublished articles are ordered as are published articles according to the above set of principles. (These however have not been employed in nomenclature).

It should be noted that many journals and some symposium volumes carry only one date, i.e. that year to which the journal pertains or the date on which the symposium was held, but do not indicate the date of actual publication. It is unfortunate that these dates, which sometimes are as much as two or three years earlier than the publication date, have to be adhered to according to priority. In this way certain articles may be favoured with a priority rating as many as fifty or more entries ahead of an article which was actually published at an earlier date.

In applying specific names the hypodigm for the species in question (included on the 'species pages') was consulted. The earliest validly published name coined for Gondwana Permian material and not otherwise occupied, has been adopted. In only two cases (*Circulisporites parvus* de Jers. 1962 from the Triassic of Queensland; and *Laevigatosporites vulgaris* Ibrahim 1933 from an unspecified horizon from the Northern Hemisphere) have names not originally coined for Gondwana Permian material been adopted. These two names have been applied since they have been widely and consistently used in the Gondwana Permian literature. In cases where a new name was coined without fully complying with the rules of valid publication, but where the material on which it is based is relatively well illustrated and where the name has been relatively widely used since, it has been adopted.

In the case of genera the earliest appropriate name, whether or not originally coined for Gondwana Permian material, has been applied. The reasons, all related, for this shift of emphasis to include consideration of non-Gondwana Permian names (in contrast to the approach in species naming) are firstly that genera obviously have a far wider geographic and stratigraphic range; secondly that the proportion of generic names, in the literature considered, created for Gondwana Permian material relative to those adopted from other sources is far lower, i.e. between 1/3 and 1/2, compared to the proportion for specific names which is ± 6/7; and thirdly that far fewer generic names (33) as opposed to specific names (133) have to be retrieved for application to the material described in this study. Three exceptions to this rule have been adopted i.e. *Zinjisporites, Gondisporites,* and *Vestigisporites,* which are adopted solely on consideration of names coined originally for Gondwana Permian material. Frequently the earliest available generic names were originally invalidly created. They are nevertheless adopted.

4.6 NOTES ON APPENDIX 9.5: PHOTOGRAPHIC CATALOGUE

(a) General

A Zeiss photo-microscope, with Kodak Panatomic X film, was used throughout for photography. A magnification of 500 times has been applied in all photo-micrographs.

The photographic catalogue is designed to illustrate all the best 'populations' encountered in the present study such that the 133 described species are as adequately covered as possible. The populations, however, vary considerably in quantity and quality of specimens. The catalogue comprises 188 plates including 5 494 photographs making up 250 populations. Each species is thus represented on average by approximately 2 populations together including 41 specimens.

In Table 6 is indicated the varied degree to which it has been possible to illustrate the different species. The six most poorly and the six most fully illustrated species are listed. (The first figure represents the total number of miospore specimens photographed and that in brackets the number of populations).

TABLE 6 - The varied photographic coverage of particular species

Microbaculispora sp.A	1(1)	Zinjisporites spinosus	151(1)
Microbaculispora digitiformis	3(1)	Vittatina multistriata	175(6)
Quadrisporites horridus	3(1)	Vestigisporites balmei	181(1)
Tetraporina tetragona	3(1)	Pityosporites ovatus	230(1)
Microbaculispora capilliformis	4(1)	Gondisporites splendens	250(2)
Maculatasporites minimus	4(1)	Pityosporites amplus	290(6)

The six species on the left are all very rare in the northern Karoo Permian and from the assemblages studied no additional material was available for illustration. In each case only one 'population' has been encountered. The six species on the right occur very commonly. They are very variable species which might possibly merit further splitting when a number of additional good populations become available for study.

The illustrated populations derive from 24 assemblages from 11 localities (nine boreholes, two surface). The quality and diversity of miospores varies considerably between assemblages, such that the number of populations warranting illustration from each is quite different.

11 assemblages have yielded between 1 and 4 populations.
4 assemblages have yielded between 5 and 9 populations
6 assemblages have yielded between 10 and 19 populations
3 assemblages have yielded 20 or more populations

(b) *Layout*

(i) At the start of the catalogue is provided a table indicating all the populations that have been illustrated.

(ii) The species within the catalogue are arranged in the same natural order as for the 'species pages'.

(iii) Each species is illustrated by one or more simple and/or split populations. The assemblage yielding each is indicated.

(iv) Compound populations (see for example Plates 44 and 45) are titled according to all the incorporated species. The pertinent plate and photograph numbers for each species are noted. A short vertical line indicates the boundaries between the species within the population.

(v) Each photograph is supplied with two numbers. The lower number represents the photograph number per plate, whilst the higher represents the negative number. The negative numbers can be checked in the index to the negative files (housed at BPI), where the relevant strew-slide code and specimen co-ordinates are given.

TABLE 7 - The number of populations per miospore group per assemblage in the photographic catalogue

Assemblages	Acritarcha	Lycophyta	Microbaculispora	Other spores	Vestigisporites	Vittatina	Pityosporites	Lueckisporites	Other grains	TOTAL NO. Of POPULATIONS
	← Miospore groups →									
1 OW 94'				6	1	3	6	2		18
2 OW 170'				1						1
3 OW 312'				1						1
4 OW 1156'/1145'	1		5	1	2	2	3	2	1	17
5 OW 1171'	2									2
6 OW 1257'			2							2
7 SAP 6 521'			3	1						4
8 SAP 6 1019'/1000'				1	1	1		3		6
9 SAP 6 1133'/1130'	9	4	9	9		2				33
10 SAP 6 1152'9"/1151'3"	3	3	7	2		2	1		1	19
11 SAP 7 338'			3	1					1	5
12 SAP 7 464'			2	1						3
13 UC 729 555,0			2						1	3
14 P13 128,13/126,50	2									2
15 P13 147,70/146,80	1			2						3
16 P13 154,35/152,95			1							1
17 UC 678 31,6/30,6	3	2	7	2		1		1	1	17
18 UC 678 80,6/78,9	2		4	1	4	5		1	3	20
19 UC 621 153'	4	4	5	2				2	2	19
20 UC 608 1262'		1	3	4					1	9
21 UC 608 1590'				2						2
22 WV3 133,50	2	3		1		1	1		1	9
23 Kb				6		2	6	1		15
24 HKr	5	2	4	10	7	3	7		1	39
Total no. of populations	34	19	57	54	15	22	24	12	13	250

(vi) Four categories of population are involved (defined in Fig. 4). The category is indicated by a full and/or open dot(s) placed immediately to the left of the assemblage code.

●	Reference population: That population which defines the limites of a species. May be a 'simple population' or part of a 'compound population', i.e. a split population.
○	Representative population: Any other population (simple or split) whose limits fall within or approximately within those of a reference population.
○ or ●	Simple population: Incorporates only 1 species.
○ ○ or ● ● or ● ○ ○ etc.	Compound population: Incorporates more than 1 species. The dots from top to bottom represent the species as ordered in the catalogue.

FIG. 4 - Symbolic representation of the four categories of population

(vii) Where the reference population includes the type specimen, this particular specimen is indicated by two full dots alongside one another. Where the reference population does not include the type specimen, a reference specimen is designated by assigning to it a single full dot.

Systematic account of genera

5.1 ACRITARCHA

The Acritarcha (unicellular plants of non-vascular origin) described here are possibly primarily algal and fungal in origin. In the Gondwana Permian literature 23 genera and 31 species of miospore belonging to this group have been described to date. In the present revision 13 genera and 36 species (of which seven genera and 18 species are known from the Karoo) are recognized. The revised list of taxa is set out in Table 8 for which further explanation is given in Chapter 4.3a.

5.1.1 Botanical affinities

Based on general similarities with extant forms the majority of the miospores included here possibly represent unicellular algae (Evitt, 1969; Segroves, 1967). The spores of fungi, mosses and liverworts are perhaps represented to a lesser extent.

5.1.2 Generic distinctions

Mehlisphaeridium and *Maculatasporites* are clearly distinct from the remaining five genera in that their exine is differentiated into two distinct layers. The two genera are distinct from one another in the differing relative thicknesses of the intexine and exoexine and in the type of ornamentation.

Circulisporites, *Pilasporites* and *Micrhystridium* all display similar general shape and mode of dehiscence, but are distinct from one another in basic differences in type of ornamentation. *Circulisporites* possibly derived from *Pilasporites*.

Tetraporina and *Quadrisporites* are distinct and each bear a number of characteristics markedly different from the other genera.

TABLE 8 - *Acritarcha:* Revised list of Gondwana Permian genera and species

Mehlisphaeridium parvum sp. nov.	1
Mehlisphaeridium regulare sp. nov.	2
Mehlisphaeridium irregulare sp. nov.	3
Mehlisphaeridium fibratum Segr. '67	4
Mehlisphaeridium gondwanensis (Tiw. '65) comb. nov.	5
Mehlisphaeridium sp.A.	Bharad. & Sal. '64, pl. 3 (59, 60); Glick. '72, *pl. 1* (9, *10*).
Haplocystia pellucida Segr. '67	Segr. '67, *pl.2* (*1-6*); Segr. '72, pl. 5 (8).
Maculatasporites eraduensis (Segr. '67) comb. nov.	6
Maculatasporites indicus Tiw. '64	7
Maculatasporites amplus Segr. '67	Segr. '67, *pl. 3* (*15 - 18*).
Maculatasporites minimus Segr. '67	8
Maculatasporites sp.A	Glick. '72, pl. 1 (14, 15); Balme '73, *pl. 3* (*22*).
Schizosporis dejerseyi Segr. '67	Segr. '67, *pl. 1* (*9 - 12*).
Circulisporites monile (Balme & Segr. '66) comb. nov.	Balme & Segr. '66, pl. 3 (a-e); Segr. '67, *pl. 1*(*3, 4*); Glick. '72, pl. 3 (11, 12).
Circulisporites calvitum (Balme & Segr. '66) comb. nov.	Balme & Segr. '66, pl. 3 (l-m); Segr. '67, *pl. 1* (*1, 2*); Segr. '72, pl. 7 (11).
Circulisporites venosus (Balme & Segr. '66) comb. nov.	9
Circulisporites bianularis sp. nov.	10
Circulisporites parvus de Jers. '62	11
Circulisporites sp.A	Falc. '72, *pl. 5* (*17*,18)
Pilasporites scissus (Balme & Henn. '56) comb. nov.	12
Pilasporites calculus Balme & Henn. '56	13
Pilasporites sp.A	Glick. '72, *pl. 3* (13, *14*).
Pilasporites sp.B	Helby '70, *pl. 42* (19, *20-25*).
Tetraporina minuta (Tiw. & Nav. '67) comb. nov.	Tiw. & Nav. '67, *pl. 3* (*38,39*).
Tetraporina simplex sp. nov.	14
Tetraporina tetragona (Pant & Mehra '63) comb. nov.	15
Tetraporina punctata (Tiw. & Nav. '67) comb. nov.	Segr. '67, pl. 3 (22); Tiw. & Nav. '67, *pl. 3* (*32-36*); Bose & Mahesh. '68, pl. 23 (4-6); Mahesh. & Bose 69, pl.9(12).
Tetraporina horologia (Staplin) Playford	Segr. '67, *pl. 3*(*21*); Helby '70, pl. 43(18, 19); Glick. '72, pl. 5(5).
Tetraporina superba Mahesh. & Bose '69	16
Gen. et. sp.A	Glick. '72, *pl. 5*(*8*, 9).
Quadrisporites horridus Henn. '58	17
Pyramidosporites cyathodes Segr. '67	Segr. '67, *pl. 1*(*13-15*); Segr. '72, pl. 7(10); Glick. '72, pl. 4(1-6).
Micrhystridium karrooense sp. nov.	18
Baltisphaeridium sp. A	Helby '70, *pl. 42* (*30, 37, 38*), *pl. 43* (*1-3*, 6); Segr. '72, pl. 5(9).
Veryhachium sp. A	Helby '70, *pl. 42* (*31-36*).
Veryhachium sp. B	Helby '70, *pl. 43* (4,*5*).

5.1.3 Specific relationships

Mehlisphaeridium: 5 Karoo species (12 populations from 6 assemblages).

Four of the species form a MAMC. The fifth species, *M. gondwanensis* (5), is regarded as sufficiently closely related to warrant inclusion in the genus.

Maculatasporites: 3 Karoo species (3 populations from 2 assemblages).

Two of the species form a MAMC. The third species, *M. eraduensis* (6), is fairly far removed from the continuum, but does not appear to warrant separate generic status.

Circulisporites: 3 Karoo species (8 populations from 8 assemblages).

None of the species form a MAMC. The three species have clear morphological breaks separating them and should possibly be included in three separate genera. Consideration of the three additional species found elsewhere in Gondwanaland does not narrow the breaks. *C monile* and *C. calvitum* are obviously very closely related to *C. venosus* (9) and *C. sp. A* to *C. parvus* (11). It is possible that the three Karoo species are not even related to the extent of belonging to a single family, the pattern of ornamentation presenting an apparent rather than a real relationship.

Pilasporites: 2 Karoo species (4 populations from 3 assemblages).

The two species form a MAMC.

Tetraporina: 3 Karoo species (5 populations from 2 assemblages).

None of the species form a MAMC, but they are clearly closely related.

Quadrisporites and Micrhystridium: These genera are each represented by only a single species in the Karoo Basin, and each is illustrated by a single population.

5.1.4 Generic descriptions

MEHLISPHAERIDIUM Segr. '67

TYPE SPECIES	*Mehlisphaeridium fibratum* Segr. '67, pl. 2 (8-14), p. 295; original designation.
DESCRIPTION	
Shape	Amb circular; body spheriodal.
Dehiscence	Without apparent dehiscence.
Exine	With two distinct layers;
	Intexine: relatively thick, unsculptured.
	Exoexine: relatively thin, sculptured.
Ornament	Arrangement: type of ornamentation consistent on any one specimen and scattered more or less evenly across the entire body surface.
	Description: elements hollow; setate, baculate, pilate, coarsely conate, reticulate or irregularly shaped; 1 to 30 μm. high.
Size	24(30)36 to 60(80)100.

MACULATASPORITES Tiw. '64

TYPE SPECIES	*Maculatasporites indicus* Tiw. '64, pl. 1 (11, 12) p. 257; original designation.
DESCRIPTION	
Shape	Amb circular; body spheriodal.
Dehiscence	Without apparent dehiscence.
Exine	With two distinct layers;
	Intexine: very thin, unsculptured
	Exoexine: thick, sculptured.
Ornament	Arrangement: type of ornamentation consistent on any one specimen and scattered more or less evenly across the entire body surface.
	Description: very finely foveolate (lumina 1/10 to 1/5 μm in diameter) to coarsely foveolate (lumina up to 14 μm in diameter).
Size	32(39)46 to 52(69)86.

CIRCULISPORITES de Jers. '62

TYPE SPECIES	*Circulisporites parvus* de Jers. '62, pl. 5 (13-15), p. 15; original designation.
DESCRIPTION	
Shape	Amb circular; body spheriodal to oblate spheriodal.
Dehiscence	Splits along equator into two symmetrical halves.
Exine	No apparent differentiation into two distinct layers.
Ornament	Arrangement: confined primarily to a series of concentric ridges.
	Description: concentric ridges, 1 to ± 20 per hemisphere, which are either levigate, baculate or otherwise ornamented; inter-ridge areas either levigate or crossed by relatively fine radial forking or anastomosing ridges; polar regions irregularly baculate (2 species).
Size	16(19)22 to 54(57)60.

PILASPORITES Balme & Henn. '56

TYPE SPECIES	*Pilasporites calculus* Balme & Henn. '56, pl. 3 (60-64), p. 64; original designation.
DESCRIPTION	
Shape	Amb circular- body spheriodal.
Dehiscence	Splits parallel to equator into two not quite symmetrical halves.
Exine	No apparent differentiation into two distinct layers; ± 1/10 to 2 μm thick.
Ornament	Levigate.
Size	16(18)20 to 80.

TETRAPORINA Naumova '39 ex Naumova '50

TYPE SPECIES	*Tetraporina antiqua* Naumova '50, pl. 1 (25), p. 106; designated by Potonié '60, p. 130.
DESCRIPTION	
Shape	Amb quadrilateral, sides slightly convex to slightly concave, body more or less lenticular in cross-section.
Dehiscence	Porate; pores circular, 4 in number and situated at the corners of the quadrilateral; pores indistinct to very distinct, 3 μm (or less) to 16 μm in diameter.
Exine	No apparent differentiation into two distinct layers.
Ornament	Levigate.
Size	20 to 66(84)102.

QUADRISPORITES Henn. '58

TYPE SPECIES	*Quadrisporites horridus* Henn. '58, pl. 5 (6, 7), p. 364; original designation.
DESCRIPTION	
Shape	Quadrilaterally to slightly rhomboidally arranged tetrad, almost invariably intact.
Dehiscence	Isolated individual apparently alete.
Exine	No apparent differentiation into two distinct layers.
Ornament	Arrangement: type of ornamentation more or less consistent on any one specimen and scattered densely throughout, but for the contact area, which is apparently levigate. Description: dominantly relatively coarsely spinate.
Size	(full tetrad) 50(60)70.

MICRHYSTRIDIUM Deflandre '37, emend
Downie & Sarjeant '63

TYPE SPECIES	*Micrhystridium inconspicuum* Deflandre '37; original designation.
DESCRIPTION	
Shape	Amb circular- body spheriodal.
Dehiscence	Circular dehiscent cap somewhat smaller than half of body size.
Exine	No apparent differentiation into two distinct layers.
Ornament	Arrangement: type of ornamentation more or less consistent on any one specimen and scattered fairly evenly throughout. Description: sparsely to fairly densely setate to spinate (1/5 to 4 μm high).
Size	14(18)22.

5.2 LYCOPHYTA

The miospores discussed here can be reasonably confidently grouped under The Lycophyta (see 5.2.1). In the Gondwana Permian literature 28 genera and 53 species of miospore belonging to this group have been described to date. In the present revision only two genera and 15 species (both genera and 12 of the species are known from the northern Karoo) are recognized. The revised list of taxa is set out in Table 9 for which further explanation is given in Chapter 4.3a.

5.2.1 Botanical affinities

Chaloner (1967) in his review of the fossil Lycophyta lists 26 distinct genera of sporangia known to date. By far the greater number of these derive from the Carboniferous of Euramerica where the Lycophyta were a dominant element of the flora. Microspores from 13 of these genera have been extracted and illustrated and/or described. The majority of these microspores are of the same basic easily distinguished morphological type and display the following combination of characteristics: trilete; cavate; with clear flat contact faces occupying all of the proximal surface and bounded by distinct curvaturae; cingulate often with the development of a distinct zona or corona; variously ornamented on the distal face. Furthermore, as far as the author is aware, no spores of this general type have been extracted from non-lycophyte fructifications.

The two genera *Zinjisporites* and *Gondisporites*, described here, clearly fall within the above general spore type. Although no microspores have been isolated from Permian Gondwana lycophyte sporangia, these two genera may with confidence be assigned to the Lycophyta.

The macrofloral remains of Lycophyta in the Permian Gondwana are in urgent need of revision, with the result that it is not possible to make a realistic assessment of their diversity. The delimitation of genera and species of the miospores within this group must therefore be made independent of the macrofloral evidence.

5.2.2 Generic distinctions

The only morphological characteristic distinguishing *Zinjisporites* from *Gondisporites* is the ornamentation. *Zinjisporites* displays an intrareticulate to rugulate foundation to its ornamentation which does not occur in *Gondisporites.* The two species included in *Zinjisporites* on the one hand and the cluster of species included in *Gondisporites* on the other, appear distinct enough to warrant their assignment to different genera.

5.2.3 Specific relationships

Zinjisporites: 2 Karoo species (3 populations from 3 assemblages).

The two species form a MAMC.

Gondisporites: 10 Karoo species (16 populations from 6 assemblages).

Nine of the 10 species form a MAMC. The tenth species, *G. regularis* (28) appears to be closely related to *G. congoensis* (26).

The natural relationships apparent from a study of morphology between the species of *Gondisporites* are too complex to indicate on a simple two-dimensional chart (i.e. Chart 4). It would appear impossible to devise a scheme whereby each species within the genus can be simply derived from some other species. Hybridization between different species in different places at different times has probably occurred. The scheme of relationships plotted on Chart 4 is very simplified.

TABLE 9 - *Lycophyta:* revised list of Gondwana Permian genera and species

Zinjisporites congoensis (Mahesh. & Bose '69) comb. nov.	19
Zinjisporites spinosus (Kar & Bose '67) comb. nov.	20
Gondisporites punctatus (Hart '63) comb. nov.	21
Gondisporites parvus sp. nov.	22
Gondisporites echinatus sp. nov.	23
Gondisporites raniganjensis Bharad. '62	24
Gondisporites braziliensis (Pant & Sriv. '65) comb. nov.	25
Gondisporites congoensis (Mahesh. & Bose '69) comb. nov.	26
Gondisporites lacunatus (Tiw. '65) comb. nov.	27
Gondisporites regularis sp. nov.	28
Gondisporites complicatus (Balme '70) comb. nov.	Balme '70, *pl. 4 (1-4),* pl. 5 (4-6); Segr. '70, pl. 5(E-H); Segr. '72, pl. 1(2), pl. 2(5); Glick. '72, pl. 14 (1-8).
Gondisporites rotundidentatus (Segr. '70) comb. nov.	Segr. '70, *pl. 6(C), pl. 7(D-F);* Segr. '72, pl. 1(3), pl. 2(6); Balme '73, pl. 7(7), pl. 8(6).
Gondisporites variabilis sp. nov.	29
Gondisporites splendens (Balme & Henn. '56) comb. nov.	30
Gondisporites sp. 1	Bharad. '69, *pl. 1(21-23, 27);* Kemp in press, pl. 1(12, 13, 16), pl. 2 (6, 7).

5.2.4 Generic descriptions

ZINJISPORITES Hart '63

TYPE SPECIES	*Zinjisporites zonalis* Hart '63, pl. 1(11), p. 15; original designation.
DESCRIPTION	
Shape	Amb triangular, sides strongly convex, angles pointed.
Contact faces	Fully developed, flat, levigate, occupying all of proximal face; bounded by distinct curvaturae which form the equatorial margin of the spore.
Trilete mark	Rays: Extend full radius Labra: Fairly weakly to fairly strongly developed.
Exine	Distinct intexine and exoexine developed; intexine often clearly detached and visible resulting in a cavate condition, but also often not visible. Intexine: <0,1 μm thick Exoexine: Ventral face ± 1-4 μm thick, contact faces probably thinner.
Equatorial region	Weakly cingulate; with a delicate spinose corona 0(3)6 μm broad (1 species), or a heavy spinose corona 0(7)14 μm broad (1 species).
Ornament	Contact faces levigate; ventral surface finely to coarsely intrareticulate to rugulate with varied development of irregular spines.
Size	32(41)50 to 36(71)106.

GONDISPORITES Bharad. '62

TYPE SPECIES	*Gondisporites raniganjensis* Bharad. '62, pl. 6(66, 67), p. 84; original designation.
DESCRIPTION	
Shape	Amb triangular (with strongly convex sides, and somewhat pointed to rounded angles) to almost circular.
Contact faces	Fully developed, flat, levigate, occupying all of proximal face; bounded by distinct curvaturae which form the equatorial margin of the spore.
Trilete mark	Rays: extend full radius Labra: undeveloped, weakly developed or fairly strongly developed.

Exine	Distinct intexine and exoexine developed, intexine often clearly detached and visible (resulting in a cavate condition), but also often not visible Intexine: $<0,1$ μm thick, i.e. distinctly thinner than the exoexine (*G. complicatus* and *G. sp. A.*, in which the intexine is apparently thicker than the exoexine, are exceptions) Exoexine: ventral face ± 1-6 μm thick, contact faces probably thinner.
Equatorial region	Weakly to strongly cingulate; cingulum generally evenly broad throughout (12 species) or broadening towards centre of inter-ray area; margin of cingulum finely to coarsely granulate, papillate, spinate, echinate or spongeous, or with the development of a narrow to broad zona or spinose corona.
Ornament	Contact faces levigate; ventral surface finely to coarsely granulate, papillate, spinate, echinate, verrucate or spongeous.
Size	24(32)40 to 64(82)100.

5.3 SPHENOPHYTA AND FILICOPHYTA

The majority of the miospores discussed here probably belong to the Sphenophyta and Filicophyta although some may belong to the Algae, Bryophyta, Lycophyta or Pteridospermophyta (see 5.2.1). In the Gondwana Permian literature 94 genera and 201 species of miospore belonging to this group have been described to date. In the present revision 23 genera and 93 species (15 genera and 61 of the species are known from the northern Karoo) are recognized. The revised list of taxa is set out in Table 10 for which further explanation is given in Chapter 4.3a.

TABLE 10 - *Sphenophyta and Filicophyta:* revised list of Gondwana Permian genera and species

Acanthotriletes (levigate forms)	31
Acanthotriletes (granulate forms)	32
Acanthotriletes (spinate forms)	33
Acanthotriletes (baculate/pilate forms)	34
Acanthotriletes (forms with branching baculae)	35
Indospora clara Bharad. '62	Bharad. '62, pl. 3 (54-60); Bharad. & Sal. '64, pl. 2(51-56), pl. 3(57); Bharad. & Sal. '65a, pl. 1(24); Kar '68a, pl. 1(23-25); Balme '70, pl. 3(11); Helby '70, pl. 12(4-12, 14-17); Segr. '70, *pl. 5*(A, *B*); Glick. '72, pl. 8(15, 16); Balme '73, pl. 2(5).
Microreticulatisporites bitriangularis Balme & Henn. '56	Balme & Henn. '56b, *pl. 5(53*, 54); Balme '73, pl. 2(2).
Microbaculispora labyrinthica sp. nov.	36
Microbaculispora microreticulata sp. nov.	37
Microbaculispora virkkiae (Tiw. '65) comb. nov.	38
Microbaculispora plicata (Mahesh. & Bose '69) comb. nov.	39
Microbaculispora directa (Balme & Henn. '56) comb. nov.	40
Microbaculispora tentula Tiw. '65	41
Microbaculispora finegranulata sp. nov.	42
Microbaculispora mediogranulata sp. nov.	43
Microbaculispora grandegranulata sp. nov.	44
Microbaculispora quadruplex (Segr. '70) comb. nov.	Segr. '70, *pl. 2(i-k);* Mahesh. & Bose '69, pl. 2(22); Segr. '72, pl. 4(1).
Microbaculispora micronodosa (Balme & Henn. '56) comb. nov.	45
Microbaculispora sp. B.	Balme'73, *pl.2(8).*
Microbaculispora trisina (Balme & Henn. '56) comb. nov.	46
Microbaculispora gondwanensis comb. nov.	47
Microbaculispora villosa (Balme & Henn. '56) Bharad. '62	48
Microbaculispora uncinata (Balme & Henn. '56) comb. nov.	Balme & Henn. '56b, *pl.3* (35, *36*).
Microbaculispora ericiana (Balme & Henn. '56) comb. nov.	49
Microbaculispora dentata (Balme & Henn. '56) comb. nov.	Balme & Henn..'56b, *pl.3 (34).*
Microbaculispora eoericiana sp. nov.	50
Microbaculispora pseudoreticulata (Balme & Henn.'56)comb nov	51
Microbaculispora raniganjensis (Bharad. '62) comb. nov.	Bharad. '62, *pl. 2(48*, 49); Helby '70, pl. 11(9, 13, 15).
Microbaculispora sp. C	Segr. '70, *pl. 6(F).*
Microbaculispora sp. D	Bharad. '62, pl. 3(64); Bharad. Sah & Tiw. '65, pl. 1(9); Venk. & Kar '68a, pl. 2(43, 44); Segr. '70, *pl. 8(F);* Glick. '72, pl. 13(6, 7).
Microbaculispora naumovae (Hart '63) comb. nov.	52
Microbaculispora pentagonalis sp. nov.	53
Microbaculispora irregularis sp. nov.	54
Microbaculispora biornata (Balme & Henn. '56) comb. nov.	Balme & Henn. '56b, *pl. 5(55*, 56).
Microbaculispora plumsteadi (Hart '63) comb. nov.	55
Microbaculispora lageniformis sp. nov.	56
Microbaculispora paramicronodosa sp. nov.	57
Microbaculispora paratentula sp. nov.	58

Table 10 (continued)

Microbaculispora townrowii (Segr. '70) comb. nov.	Balme '64, pl. 3(19); Tiw. & Nav. '67, pl. 1(9, 10); Segr. '70, *pl. 3(D-F,* G); Segr. '72, pl. 2(3); Rakoto '70, pl. 2(14); Balme '73, pl. 5(3).
Microbaculispora praeclara (Mahesh. & Bose '64) comb. nov.	Mahesh. & Bose '69, *pl. 3(1-8);* Falc. '72, pl. 3(1-6).
Microbaculispora spinosa sp. nov.	59
Microbaculispora capilliformis sp. nov.	60
Microbaculispora digitiformis sp. nov.	61
Microbaculispora sp. E.	Balme '73, *pl. 7(9).*
Microbaculispora sp. A.	62
Gracilispora membranosa gen. et. sp. nov.	63
Dulhuntyispora parvithola (Balme & Henn. '56) Pot. '60	Balme & Henn. '56b, pl. 10(76-80); Hill & Woods '63, pl. 15(14,15); Balme '64, pl. 4(4); Segr. '70, *pl. 6(A, B);* Segr. '72, pl. 6(5); Helby '70, pl. 13(13-16); Balme '73, pl. 2(22).
Dulhuntyispora dulhuntyi Pot. '56	64
Pachytriletes densus Bose & Kar '66	65
Punctatisporites gracilis sp. nov.	66
Punctatisporites exila (Bharad. & Sal. '64) comb. nov.	Bharad. & Sal. '64, pl. 1(16, 17); Bharad. & Sal. '65a, pl. 1(5); Tiw. & Nav. '67, pl. 1(2); Bose & Mahesh. '68, pl. 3(11, 12); Mahesh. & Bose '69, *pl. 2(2-5);* Balme '73, pl. 7(14), pl. 8(7).
Punctatisporites parvus sp. nov.	67
Punctatisporites medius sp. nov.	68
Punctatisporites gretensis Balme & Henn. '56.	69
Paucipunctatosporites karrooensis gen. et. sp. nov.	70
Altitriletes densus Venk. & Kar '68	71
Retusotriletes aridus Venk. & Kar '68	Venk. & Kar '68b, *pl. 1(1, 2).*
Ricaspora granulata Bharad. & Sal. '64	Bharad. & Sal. '64, *pl. 1(10,* 11, 12).
Bipartitisporis tumulosus Segr. '70	Segr. '70, *pl. 5(C, D), pl. 6(D);* Glick.'72, pl. 12 (1-5).
Cyclogranisporites intrareticulatus sp. nov.	72
Cyclogranisporites poniatiensis (Bharad. '62) comb. nov.	Bharad. '62, *pl. 1(4,* 5, 6, 7), pl. 2(38-40); Tiw. '68a, pl. 1(23, 25-27).
Cyclogranisporites cf. planiverrucatus (Imgrund) comb. nov.	Balme '70, *pl. 2(10, 11).*
Cyclogranisporites indicus (Bharad. & Sal.) '64) comb. nov.	Bharad. '62, pl. 1(15), *pl. 2(37,* 39, 40); Bharad. & Sal. '64, pl. 1(9,25), pl. 2(45, 46); Tiw. '65, pl. 1(10, 11).
Cyclogranisporites verrucosus sp. nov.	73
Cyclogranisporites parvus (Lak., Sah & Dube '60) comb. nov.	74
Cyclogranisporites bhardwaji (Hart '63) comb. nov.	75
Calamospora landiana Balme '70	Balme '70, *pl. 1(16, 17).*
Calamospora aplata Bharad. & Sal. '64	76
Calamospora sinesignis sp. nov.	77
Inaperturosporites inapertus gen. et. sp. nov.	78
Inaperturosporites vesiculatus sp. nov.	79
Partimtactosporites verrucosus gen. et. sp. nov.	80
Apiculatisporis diversiformis (Balme & Henn. '56) comb. nov.	81
Apiculatisporis minor sp. nov.	82
Apiculatisporis major sp. nov.	83
Apiculatisporis levis (Balme & Henn. '56) Bose & Mahesh. '68	84
Apiculatisporis bulliensis (Henn. '58) comb. nov.	85
Apiculatisporis cornutus (Balme & Henn. '56) Hoeg & Bose '60	86
Apiculatisporis scotinus (Segr. '70) comb. nov.	Segr. '70, *pl. 4(A-D);* Segr. '72, pl. 2(2).
Verrucosisporites bullatus Balme & Henn. '56	Balme & Henn. '56b, *pl. 4(45,* 46, 47).
Verrucosisporites trisecatus Balme & Henn. '56	Balme & Henn. '56b, pl. 4(48, 49), pl. 5(50); Helby '70, *pl. 5(5, 6, 8, 9).*
Verrucosisporites sp. A.	Segr. '70, *pl. 4(J-K);* Segr. '72, pl. 6(2).
Lycopodiumsporites sp. A.	Bharad. '62, *pl. 3(62,* 63).
Polypodiisporites cf. minutus (Ibrahim) comb. nov.	Balme '70, *pl. 6(1-3).*
Polypodiisporites modicus (Balme & Henn. '56) comb. nov.	Balme & Henn.'56a, *pl. 1(10,* 11-13); Lesch '59, pl. 1(12); Bharad. & Sal. '64, pl. 3(65-68); Bharad. '69, pl. 1(11-13); Segr. '70, pl. 11(F, G); Segr. '72, pl. 4(4); Falc. '72, pl. 3(21-25).
Polypodiisporites detritus (Lesch. '59) comb. nov.	87
Polypodiisporites mutabilis Balme '70	88
Laevigatosporites vulgaris Ibrahim '33	89
Laevigatosporites striatus (Sal. '65) comb. nov.	90
Laevigatosporites varistriatus sp. nov.	91
Verrucososporites sp. A.	Balme '70, *pl. 6(12, 13);* Balme '73, pl. 2(12).
Verrucososporites cicatricosus Balme & Henn. '56	Balme & Henn. '56a, *pl. 1* (14-20, *21);* Helby '70, pl. 25 (26, 27, 31).

5.3.1 Botanical affinities

As far as the writer is aware, in only one instance for the Gondwana Permian have spores (excluding Lycophyta) been isolated from a parent body. Srivastava (1955) macerated sori from a single fertile pecopterid frond fragment from the Raniganj Stage, Raniganj Coalfield, India. The sori yielded abundant spores which, from the single poorly photographed specimen, appear to compare most closely with *Cyclogranisporites verrucosus* (73).

From the Upper Paleozoic and Lower Mesozoic of the Northern Hemisphere more information is available, part of which is briefly summarized by Chaloner, 1969. Spores of the *Calamospora* type have been extracted from sphenophyte sporangia. Spores referred to the genera *Punctatisporites, Punctatosporites, Osmundacidites, Granulatisporites* and *Deltoidospora* (all genera which have been adopted from time to time to house spores from the Gondwana Permian), have for instance been isolated from various fertile fern fronds.

The greater fraction of the spore types included in this section probably derive from the Sphenophyta and Filicophyta. The Lycophyta, Bryophyta, Pteridospermophyta and the red and brown algae may also be represented. The Bryophyta (mosses and liverworts) quite commonly produce tetrads of trilete spores, as to a lesser extent do some members of the red and brown algae.

5.3.2 Generic distinctions

Most of the 15 Karoo genera are clearly distinct from one another, with no morphological continuity across their boundaries. The closest relationships which do occur are briefly enumerated below.

Gracilispora and *Dulhuntyispora* quite probably belong in the same natural family as *Microbaculispora.* The features which suggest this are the overall shape, the tendency to the development of wafer-like labra, and in *Dulhuntyispora* the ordered ornamentation. Each, however, is distinct from *Microbaculispora* in the differentiation of the exine into distinct layers; in *Dulhuntyispora* only partially in the development of the three inter-radial blisters and in *Gracilispora* fully (as seen at least in polar view).

Partimtactosporites and *Cyclogranisporites* are apparently closely rèlated. Poorly preserved specimens are easily confusable. The differentiating feature is the partial development of contact faces in *Partimtactosporites* and the lack thereof in *Cyclogranisporites.*

Poorly preserved specimens of *Calamospora* are easily confused with *Inaperturosporites,* but the 2 genera are most probably unrelated.

5.3.3 Specific relationships

Acanthotriletes: 5 Karoo 'forms' (5 populations from 4 assemblages). The 'forms' are not individually described or named since it is felt that more good populations need to be documented before a realistic attempt at speciation can be made.

In two of the assemblages all five 'forms' together constitute compound populations; in one assemblage the three 'forms' occurring constitute a compound population; whilst only in the fourth assemblage (i.e. Kb) are the two 'forms' that occur distinct.

Microbaculispora: 27 Karoo species (57 populations from 14 assemblages). The genus, as here defined, incorporating 27 species from the Karoo Basin and 39 species from Gondwanaland as a whole, constitutes an extremely interesting and significant group of spores. In the Permian Gondwana literature 24 different generic names have from time to time been invoked to house the variety of forms within the group. However, the 39 species, although displaying a remarkable diversity of ornamentation, appear to be very closely related, and are readily distinguished from other spore genera. The most characteristic features of the genus are the well developed, thin, wafer-like labra associated with the rays of the trilete mark; the regular, ordered impression given by the arrangement of the ornament elements; and the characteristic fold patterns resulting when specimens are compressed other than in the equatorial plane. The species, which form part of an intricate morphological continuum, are defined purely according to the combination of overall size and type of ornamentation.

The 11 species bearing one or two distinct rows of enlarged elements roughly bordering the contact faces, do not constitute a separate genus or even a naturally related sub-group within the genus. The characteristic appears to have evolved independently at various times from different species, e.g. *M. paramicronodosa* (57) from *M. micronodosa* (45); *M. paratentula* (58) from *M. tentula* (41); *M. capilliformis* (60) from *M. directa* (40).

The genus is about as common as the Lycophyta or all the remaining spores considered together, but there is no evidence available as to the parent stock.

In 7 of the assemblages, 5 or more species are represented, whilst in 2 of these, UC 678 31,6/30,6 and SAP 6 1133'/1130', 10 and 11 species respectively occur. This indicates that a remarkable variety of species belonging to the genus probably occurred within a restricted geographical area.

Sixteen of the 27 species form a MAMC. The remaining 11 species are obviously very closely related to the continuum and with the documentation of additional populations the minor morphological breaks presently apparent may well disappear.

Punctatisporites: 4 Karoo species (5 populations from 4 assemblages).

Three of the species comprise a single compound population in assemblage UC 608 1262', whilst the four species form a MAMC.

Cyclogranisporites: 4 Karoo species (5 populations from 4 assemblages).

The four species form a MAMC.

Apiculatisporis: 6 Karoo species (13 populations from 7 assemblages).

Two of the species *A. bulliensis* (85) and *A. cornutus* (86) form a compound population in assemblage SAP 6 1133'/1130'. Although the remaining four species do not link with these two species to form a morphological continuum, three of them are clearly closely related. *A. diversiformis* (81) is morphologically somewhat further removed and could possibly be included in a separate genus.

Laevigatosporites: 3 Karoo spcies (4 populations from 3 assemblages). All three reference populations derive from HKr which of all the assemblages studied yielded by far the best populations within the genus. Two of the species form a compound population in assemblage HKr. Although the remaining species *L. varistriatus* (91) does not link with these to form a morphological continuum, it is clearly closely related.

Remaining 9 genera: These genera display very limited diversification, each being represented in the Karoo Basin by only one or two species. The inclusion in the genus *Inaperturosporites* of the two species *I. inapertus* (78) and *I. vesiculatus* (79) is possibly artificial, but with the limited data available their true relationship cannot be ascertained.

5.3.4 Generic descriptions

ACANTHOTRILETES Naumova '37

TYPE SPECIES	*Acanthotriletes ciliatus* (Knox) Potonié and Kremp '54; designated by Potonié and Kremp '54, p. 133.
DESCRIPTION	
Shape	Amb triangular, sides generally concave, but occasionally straight or slightly convex, angles rounded.
Contact faces	Not developed.
Trilete mark	Rays: extend $^{1}/_{2}$ to 4/5 radius Labra: not developed Tori: pseudotori weakly to strongly developed.
Exine	No distinction into intexine and exoexine; ± $^{1}/_{2}$ to $1^{1}/_{2}$ μm thick.
Ornament	Arrangement: processes diminish in size or are absent over the area occupied by trilete mark and tori, but are otherwise more or less evenly scattered throughout; type or ornament more or less consistent on any particular specimen. Description: levigate, granulate, spinate, pilate or baculate (simple or branched).
Size	22 to 62 μm.

MICROBACULISPORA Bharad. '62

TYPE SPECIES	*Microbaculispora gondwanensis* Bharad. '62, pl. 2(33-35), p. 80; original designation.
DESCRIPTION	
Shape	Amb triangular, sides convex, angles rounded; fold patterns and resulting shapes of specimens compressed other than in the equatorial plane, are very characteristic and more or less unique to the genus.
Contact faces	Well developed, approximately flat; no clearly developed curvaturae, the outer margins of the contact faces merging with the ventral surface.
Trilete mark	Rays: extend to margins of contact faces Labra: well developed, thin, wafer-like.
Ornament	Arrangement: primarily confined to ventral surface, the contact faces being either levigate or very weakly ornamented; distal ornamentation gives a neat, ordered, regular impression; elements of consistent type on any particular specimen other than for diminishing in size towards the margins of the contact faces (26 species), or of two distinct types intermixed which diminish in size towards the contact faces (1 species), or of consistent type but for 1 or 2 distinct rows of enlarged elements roughly bordering the contact faces (11 species). Description: ventral face - levigate, granulate, gemmate, verrucate, papillate, conate, spinate, foveolate, coarsely punctate, vermiculate, intrareticulate or reticulate. Rows of enlarged elements - granulate, spinate, setate, baculate or gemmate.
Size	32(34)36 to 110.

GRACILISPORA gen. nov.

TYPE SPECIES	*Gracilispora membranosa* gen. et. sp. nov.
DESCRIPTION	
Shape	Amb triangular, sides convex, angles rounded.
Contact faces	Not clear, presumably partially developed; no curvaturae.
Trilete mark	Rays: extend ± 2/3 to 3/4 radius Labra: well developed, thin, wafer-like.
Ornament	Levigate.
Exine	With two distinct very thin layers, each distinctly <1 μm thick.
Size	68(78)88.

DULHUNTYISPORA Potonié '56

TYPE SPECIES	*Dulhuntyispora dulhuntyi* Potonié '56; original designation.
DESCRIPTION	
Shape	Amb triangular, sides convex but extended outwards in their middle portion by the development of inter-radial blisters, angles rounded.
Contact faces	Not developed.
Trilete mark	Rays: extend ± 4/5 radius Labra: undeveloped to fairly well developed.
Inter-radial blisters	Basal diameter $^{1}/_{2}$ diameter of spore (*D. dulhuntyi*), to 1/4 diameter of spore (*D. parvithola*)
Ornament	Relatively fine reticulum merging into a series of ridges radiating out from and originating on the blisters (*D. dulhuntyi*), to relatively coarse reticulum throughout (*D. parvithola*).
Exine	Single layer, ± 3 to 4 μm thick.
Size	95 (*D. parvithola*) to 94 (114) 134 (*D. dulhyntyi).*

PACHYTRILETES Bose & Kar '66

TYPE SPECIES	*Pachytriletes densus* Bose & Kar '66, pl. 19(11, 12), p. 65; original designation.
DESCRIPTION	
Shape	Amb triangular, sides convex, angles sharply rounded.
Contact faces	Not clear, presumably partially developed; no curvaturae.
Trilete mark	Rays: extend ± 4/5 radius Labra: thick, heavily developed, extend the full length of the rays.
Ornament	Levigate.
Exine	Single layer, 2(4)6 μm thick.
Size	32(45)58.

PUNCTATISPORITES Ibrahim '33, emend.
Potonié & Kremp '54

TYPE SPECIES	*Punctatisporites punctatus* (Ibrahim) Ibrahim '33; original designation.
DESCRIPTION	
Shape	Amb circular to very roundly triangular; body spheroidal.
Contact faces	Very slightly developed.
Trilete mark	Rays: extend ± 3/4 radius. Labra: not developed.
Ornament	Levigate.
Exine	Single layer, <1 μm (with a strong tendency to folding) to 3 μm (with very little or no tendency to folding) thick.
Size	28(32)36 to 84(99)114.

PAUCIPUNCTATOSPORITES gen. nov.

TYPE SPECIES	*Paucipunctatosporites karrooensis* gen. et. sp. nov.
DESCRIPTION	
Shape	Amb triangular, sides convex, angles rounded.
Contact faces	Not developed.
Trilete mark	Rays: extend ± 3/4 radius Labra: not developed.
Ornament	Arrangement: elements consistent, scattered evenly throughout Description: relatively sparsely foveolate.
Exine	Single layer, 1(2)3 μm thick.
Size	50(59)68.

ALTITRILETES Venk. & Kar '68

TYPE SPECIES	*Altitriletes densus* Venk. & Kar '68 pl. 2(38-42), p. 64; original designation.
DESCRIPTION	
Shape	Amb very roundly triangular; body spheroidal.
Contact faces	Very slightly developed.
Trilete mark	Rays: extend ± 2/3 to 3/4 radius. Labra: extend full length of rays and terminate in a distinct boss.
Ornament	Levigate with or without a very variable number of unevenly scattered irregular gemmate excrescenses.
Exine	Single layer, ± 0,2 μm thick.
Size	54(63)72.

CYCLOGRANISPORITES Potonié & Kremp '54

TYPE SPECIES	*Cyclogranisporites leopoldi* (Kremp) Potonié & Kremp '54; original designation.
DESCRIPTION	
Shape	Amb circular; body spheroidal.
Contact faces	Not developed.
Trilete mark	Rays: extend ± $^{1}/_{2}$ to 2/3 radius Labra: undeveloped to relatively well developed; the full range usually occurs within each species.
Ornament	Arrangement: elements consistent (*C. bhardwaji* is an exception with variable elements), scattered evenly throughout Description: coarsely intrareticulate, verrucate, granulate, conate, spinate, baculate, pilate or irregularly coarsely punctate.
Exine	Single layer distinctly <1 to ± 3 μm thick.
Size	30(32)34 to 92.

CALAMOSPORA Schopf, Wilson & Bentall '44

TYPE SPECIES	*Calamospora hartungiana* Schopf, Wilson & Bentall '44; original designation.
DESCRIPTION	
Shape	Amb circular; body spherical.
Contact faces	Not developed.
Trilete mark	Rays: extend ± 1/3 radius Labra: not developed Torus: undeveloped to weakly developed plane field-tori.
Ornament	Arrangement: elements consistent, scattered evenly throughout Description: levigate to very faintly granulate.
Exine	Single layer, distinctly <1 μm thick.
Size	34(46)58 to 84(88)91.

INAPERTUROSPORITES gen. nov.

TYPE SPECIES	*Inaperturosporites vesiculatus* gen. et. sp. nov.
DESCRIPTION	
Shape	Amb circular; body spherical.
Contact faces	Not developed.
Trilete mark	Alete.
Ornament	Levigate.
Exine	Single layer, distinctly <1 μm thick.
? Perine	No perine, or with a very thin well separated perine.
Size	46(54)62 to 54(64)74.

PARTIMTACTOSPORITES gen. nov.

TYPE SPECIES	*Partimtactosporites verrucosus* gen. et. sp. nov.
DESCRIPTION	
Shape	Amb very roundly triangular.
Contact faces	Partially developed; no curvaturae.
Trilete mark	Rays: extend ± 2/3 radius Labra: fairly well developed.
Ornament	Arrangement: elements consistent and scattered evenly on ventral surface, but become finer across contact faces towards the dorsal pole. Description: verrucate.
Exine	Single layer, ± 1 μm thick.
Size	26(40)54.

APICULATISPORIS Potonié & Kremp '56

TYPE SPECIES	*Apiculatisporis aculeatus* (Ibrahim) Potonié & Kremp '56; original designation.
DESCRIPTION	
Shape	Amb circular to very roundly triangular.
Contact faces	Fully developed flat contact faces occupying most of proximal face; bounded by distinct curvaturae.
Trilete mark	Rays: extend to junction between adjacent curvaturae Labra: undeveloped to paralled sided stretching full length of rays, to tapering stretching full length of rays. Torus: narrow convex band tori; diffuse tori; or tori apparently absent or absent.
Ornament	Arrangement: elements consistent and scattered evenly on ventral surface, contact faces

	levigate. Description: levigate (1 species), bulbous granulae baring single setula (3 species), conate baculae (1 species), coarsely conate (2 species).
Exine	Single layer, ventral wall ± 1 to ± 2 μm thick; contact face walls thinner.
Size	22(25)28 to 32(36)40.

POLYPODIISPORITES Potonié & Gelletich ex Potonié '56

TYPE SPECIES	*Polypodiisporites favus* Potonié '56; designated by Potonié '56.
DESCRIPTION	
Shape	Amb oval.
Contact faces	Not developed.
Trilete mark	Ray(s): simple monolete mark (3 species), or monolete mark often tending to irregular trilete (1 species) Labra: undeveloped to weakly developed.
Ornament	Arrangement: elements consistent, scattered evenly throughout Description: medium to coarsely obervermiculate (1 species), faintly obervermiculate (1 species), granulate/spinate (1 species), or fiantly maculate (1 species).
Exine	Single layer, <1 to ± 2 μm thick.
Size	24 to 34(37)40.

LAEVIGATOSPORITES Ibrahim '33

TYPE SPECIES	*Laevigatosporites vulgaris* (Ibrahim '32) Ibrahim '33; original designation.
DESCRIPTION	
Shape	Amb oval.
Contact faces	Partially developed; no curvaturae.
Monolete mark	Ray: extends ± $^1/_2$ to 3/4 length of body. Labra: not developed.
Ornament	Levigate (1 species), coarse longitudinal to oblique ridges (1 species), coarse longitudinal to oblique ridges plus fine transverse ridges (1 species).
Exine	Single layer, ± $^1/_2$ μm thick.
Size	52(71)90 to 56(79)102.

5.4 GLOSSOPTERIDOPHYTA

The miospores discussed here are all tentatively assigned to the Glossopteridophyta although some may belong to the Pteridospermophyta, Coniferophyta or other gymnospermous classes. In the Gondwana Permian literature 119 genera and 442 species of miospore belonging to this group have been described to date. In the present revision only four genera and 49 species (all four genera and 37 of the species are known from the northern Karoo) are recognized. The revised list of taxa is set out in Table 11 for which further explanation is given in Chapter 4.3a.

5.4.1 Botanical affinities

The data available regarding the botanical affinities of the pollen grains included here are contradictory. The evidence from Gondwanaland suggests that the grains in question are derived from the Glossopteridophyta, whilst that from Euramerica suggests that this is not so.

The major part of the evidence from Gondwanaland is circumstantial. Since the earliest days of Permian palynological studies in Gondwanaland, numerous authors have noted the frequent geographic and stratigraphic association of striate disaccates with *Glossopteris*, or of the monosaccates (i.e. *Vestigisporites)* with

TABLE 11 - *Glossopteridophyta:* revised list of Gondwana Permian genera and species

Vestigisporites ventrisaccatus sp. nov.	92
Vestigisporites rudis Balme & Henn. '55	93
Vestigisporites validus (Bose & Kar '66) comb. nov.	Bose & Kar '66, *pl. 11(3, 4)*, *pl. 12(1, 2)*, pl. 32(3); Kar & Bose '67, pl. 8(1, 2); Bose & Mahesh. '68, pl. 15(1, 2).
Vestigisporites gracilis (Segr. '69) comb. nov.	94
Vestigisporites balmei Hart '60	95
Vestigisporites neglectus (Pot. & Lele '61) comb. nov.	96
Vestigisporites walikalensis (Hoeg & Bose '60) comb. nov.	97
Vestigisporites karharbarensis (Maithy '65) comb. nov.	98
Vestigisporites gondwanensis (Balme & Henn. '56) comb. nov.	99
Vestigisporites latisaccus (Kar '68) comb. nov.	Hoeg & Bose '60, pl. 32(1,3,5); Bharad. '66, pl. 1(9); Bose & Kar '66, pl. 5(3); Bose & Kar '67, pl. 1(1-3); Kar '68a, *pl. 1(33*, 34); Tiw. '68a, pl. 3(38-40); Bose & Mahesh. '68, pl. 8(1).
Vestigisporites rotatus (Balme & Henn. '56) comb. nov.	100
Vestigisporites jhingurdahiensis (Sinha '72) comb. nov.	Sinha '72, *pl. 3(42, 43).*
Vestigisporites indicus (Bharad. & Tiw. '64) comb. nov.	Bharad. & Tiw. '64a, *pl. 1(1, 2);* Bharad. & Sal. '64, pl. 3 (71, 72); Bharad. et al. '65, pl. 2(15, 16); Mahesh. '67, pl. 1(17, 18); Sinha '72, pl. 2(30), pl. 3(39, 41).

TABLE 11 - (Continued)

Vestigisporites sinuosus (Mahesh. '67) comb. nov.	Mahesh. '67, *pl. 2(21);* Glick. '72 pl. 24(2,3), pl. 25(3, 4)
Vittatina wodehousei (Venk. & Kar '64) comb. nov.	Venk. & Kar '64, *pl. 1(1-6), pl. 2(7-12), pl. 3(13-18);* Venk. & Kar '68a, pl. 8(144-148), pl. 9(149-161); Bose & Mahesh. '68, pl. 13(3); Sinha '72, pl. 5(68-70, 72, 73).
Vittatina circumsaccata sp. nov.	101
Vittatina multistriata (Balme & Henn. '55) comb. nov.	102
Vittatina nonsaccata sp. nov.	103
Vittatina simplex (Tiw. '65) comb. nov.	104
Vittatina lucifera (Bharad. & Sal. '64) comb. nov.	105
Vittatina magma (Bose & Kar '66) comb. nov.	106
Vittatina densa sp. nov.	107
Vittatina fasciolata (Balme & Henn.'56) comb. nov.	108
Vittatina globosa Mahesh. '67	Mahesh.'67, pl. 6(53); Venk.& Kar '68b, *pl.6(61-69);* Venk.& Kar '68c, pl. 2(25); Bharad.& Sinha '69b, pl. 1(10-12), pl. 2(13-17); Sinha '72, pl. 8(124).
Vittatina scutatus (Balme & Henn. '56) comb. nov.	Balme & Henn. '56a, *pl. 2* (38, *39*, 40, 41).
Vittatina triradiata (Balme & Henn. '56) comb. nov.	109
Pityosporites nectus (Venk.& Kar '68) comb. nov.	110
Pityosporites triassicus (Bharad. & Sriv. '69) comb. nov.	111
Pityosporites nucleoparvus sp. nov.	112
Pityosporites indarraensis (Segr. '69) comb. nov.	113
Pityosporites tenuicorpus (Balme '70) comb. nov.	114
Pityosporites ovatus (Balme & Henn. '55) comb. nov.	115
Pityosporites maximus (Hart '60) comb. nov.	116
Pityosporites eremus (Balme & Henn. '55) comb. nov.	Balme & Henn. '55, *pl. 5(45*, 48); Balme '64, pl. 3(16); Segr. '70, pl. 5(A); Glick.'72, pl. 34(3).
Pityosporites levis (Tiw. '64) comb. nov.	117
Pityosporites fusus (Balme & Henn. '55) comb. nov.	118
Pityosporites goraiensis (Pot. & Lele '61) comb. nov.	119
Pityosporites transitus (Bose & Kar '66) comb. nov.	Bose & Kar '66, *pl. 25(10*, 11, *12, 13), pl. 26(1, 2*, 3), pl. 33(4-6).
Pityosporites cancellatus (Balme & Henn. '55) comb. nov.	120
Pityosporites amplus (Balme & Henn. '55) comb. nov.	121
Pityosporites micros (Hart '63) comb. nov.	122
Pityosporites varimicros sp. nov.	123
Lueckisporites asulcus (Bose & Kar '66) comb. nov.	124
Lueckisporites nyakapendensis Hart '60	125
Leuckisporites vanus (Venk. & Kar '66) comb. nov.	Venk.& Kar '66b, *pl. 1(8, 9, 11);* Segr. '69, pl. 9(A, B); Segr. '72, pl. 4(10).
Lueckisporites welkomensis sp. nov.	126
Lueckisporites alatus (Venk. & Kar '66) comb. nov.	Venk.& Kar '66b, *pl. 1 (1-3, 4, 7);* Venk.& Kar '68b, pl. 2(27), pl. 3(35, 36); Segr. '69, pl. 10(A, B); Balme '70, pl. 14 (8-10).
Lueckisporites hannonicus (Goub. '65) comb. nov.	127
Lueckisporites neohannonicus sp. nov.	128
NB. (a) The material (see entries to right) falling within the genera Crucisaccites Lele & Maithy'64, Stellapollenites Lele '65 & Divarisaccites Venk. & Kar '66, are considered to be abnormal forms of Vestigisporites karharbarensis and/or V. gondwanensis and are therefore not included in the list above.	Lele & Maithy '64, pl. 1(7); Lele '65, pl. 1(1-4); Bose & Kar '66, pl. 8(1), pl. 9(1-3); Maithy '66a, pl. 2(16, 17); Venk.& Kar 66a, pl. 1(1-4); Bose & Mahesh.'66, pl. 3(1, 2), pl. 4(1, 2); Bose & Mahesh. '68, pl. 10(4, 7); Kar '69c, pl. 2(8-10), pl. 3(7-8), Rakoto.'70, pl. 15(6, 9, 11, 12, 14); Sriv. '70, pl. 2(18, 19); Daem. & Quad. '73, pl. 6 (P-393,A).
(b) The material (see entries to right) falling within the genera Striomonosaccites, Striapollenites, Distriatites (all 3 created by Bharad.'62), & Bharadwajiapollis Kar '69 are considered to be abnormal forms of Pityosporites amplus and are therefore not included in the list above.	Bharad.'62, pl. 7(107-112), pl. 8(115, 116), pl. 21(273-275), pl. 22(276-286); Bharad.& Sal. '64, pl. 4(77, 79, 80), pl. 11(153, 155), pl. 12(156-158); Bose & Kar '66, pl. 23(7, 8), pl. 24(1-3); Mahesh.'67, pl. 8(64, 65), pl. 9(69, 71); Kar '69a, pl. 1(1-10); Mahesh.'69, pl. 4(5, 6); Helby '70, pl. 28(9), pl. 29(1-4), pl. 30(3); Glick.'72, pl. 30(2-6); Sinha '72, pl. 8(107-110).

Gangamopteris. Firstly, it frequently occurs that an assemblage which is dominated by one or other of the leaf genera is likewise dominated by the respective pollen genus. Secondly a distinct parallel occurs between the two leaf genera and the respective pollen genera, in their broad patterns of stratigraphic and abundance distribution through the Permian.

As far as the writer is aware, for the Permian of Gondwanaland, only one set of direct evidence bearing on the parenthood of the pollen types included here is available. Pant (1958), Pant & Nautiyal (1960), Townrow (1962), Helby (1970) and Pant & Bhatnagar (1973) have extracted and described striate disaccate pollen grains from the sporangia genus *Arberiella*, from the Upper Permian coal measures of the Raniganj Coalfield, India; Mhukuru Coalfield, Tanzania; and the

Hunter Valley, Sydney Basin. The striate disaccate grains illustrated from *Arberiella* are all considered in this paper to fall within the rather broad specific category *Pityosporites amplus* (121). Again, by stratigraphic association, *Arberiella* is generally assumed to derive from the same parent plant as the leaf genus *Glossopteris.*

The majority of the species included here (under the 'Glossopteridophyta') are matched by apparently similar forms from the Permian of Euramerica. Frequently these forms are dominant components of the assemblages just as they are in Gondwanaland. Yet, as far as the writer is aware, neither *Gangamopteris* or *Glossopteris* are known from Euramerica.

From the Upper Permian of Europe, Visscher (1971) and Clement-Westerhoff (1974) have described pollen grains derived from the pollen sacs of cones which they regard on the basis of cuticular structure as belonging to the Coniferophyta. The grains are assigned by them to three genera which, in dispersed miospore assemblages, are dominant in the Upper Permian of Europe, i.e. *Jugasporites* Leschik (1956) *sensu* Visscher (1971) (non-taeniate), *Lueckisporites* Potonié and Klaus (1954) *emend.* Klaus (1963) (bi-taeniate) and *Lunatisporites* Leschik (1955) *emend.* Scheuring (1970) (multi-taeniate). The cones yielding the three genera are reported to show striking structural similarities.

Of the three genera only *Lueckisporites* is known from the Permian of Gondwanaland. *L. nyakapendensis* (125) which is a dominant form in the Upper Ecca and Tapinocephalus Zone equivalent in the Karoo Basin cannot be readily distinguished from the European *Lueckisporites.* The cones yielding the pollen genus in Europe are as yet unknown in Gondwanaland. In the case of the Karoo Basin this is not necessarily anomalous, since no macrofloral assemblages are known in the *Lueckisporites* bearing strata. The five species included in the genus *Lueckisporites* may thus be of coniferophyte origin.

A great deal more data must be gathered before the true botanical affinities and relationships of the grains grouped in this section will be confidently known.

5.4.2 Generic distinctions

The degree of taxonomic proliferation and confusion reached within the grains grouped in this section is far greater than in any of the other parent plant categories. It is felt that the 119 genera including 442 species that have been described in the literature can more realistically be accommodated in the four genera and 49 species as listed.

The only general attempts at revision within the group to date are those of Hart (1964, 1965). Some authors have partly followed his system, but approximately half the welter of names have appeared since. In his revision, Hart provided a taxonomic tool based on artificial morphological criteria witnessed in isolated grains scattered through time and space. Since the aim in the present work is to derive a taxonomic scheme reflecting the natural relationships of populations through time and space, Hart's scheme has not been applied.

The four genera adopted here and their chief distinguishing characteristics are:

Vestigisporites	(a)	Monosaccate, sacci relatively gracile.
	(b)	Y-mark present.
	(c)	Non-striate (in 1 species partially developed striae sometimes occur).
Vittatina	(a)	Primarily non-saccate (in 3 species sacci are developed).
	(b)	Y-mark present.
	(c)	Striate, generally with 6 to 11 ribs per 20 µm (in 2 species 4 ribs per 20 µm occur).
	(d)	Striated cappa encroaches to occupy almost all of ventral surface (in 7 of the 12 species).
Pityosporites	(a)	Disaccate, sacci relatively gracile.
	(b)	Y-mark absent.
	(c)	Non-striate or striate, striate forms generally with 3 to 5 ribs per 20 µm (in 1 species 8 ribs per 20 µm occur)
	(d)	Cappa restricted to dorsal surface.
Lueckisporites	(a)	Disaccate, sacci relatively robust.
	(b)	Y-mark absent.
	(c)	Striae reduced or absent but for a prominent central cleft dividing the cappa into 2 broad ribs.

In any artificial approach to classification the features chosen for defining a genus or higher taxa often lead to obviously closely related species being widely separated. Certain examples may be cited within the four genera under discussion.

The seven species of *Pityosporites* that occur in assemblage HKr constitute an apparently closely related freely hybridizing group of plants. Some of the species are striate others non-striate. These would normally be included in different supra-generic taxa. A consideration of the populations of *P. goraiensis* (119) from assemblages OW 94' and Kb illustrates a similar situation. This striate species is at least as closely similar to the non-striate species *P. ovatus* (115) and *P. maximus* (116) as it is to the striate species *P. cancellatus* (120) and *P. amplus* (121). In the populations cited, some specimens exhibit clearly defined striae, others weakly defined striae and still others apparently no striae at all, rendering them indistinguishable from *P. ovatus* (115) or *P. maximus* (116).

As with striae, sacci are normally regarded as features on which supra-generic taxa can be based. In the genus *Vittatina* (as here defined) however, nine species are non-saccate, one disaccate and two monosaccate. The disaccate species *V. multistriata* (102) forms, moreover, part of a compound population (in assemblage OW 1148'/1145') with the non-saccate species *V. nonsaccata* (103).

The four genera *Vestigisporites, Vittatina, Pityosporites* and *Lueckisporites,* as recognised here, are apparently related. *Vestigisporites* is probably the most primitive of the four and still retains certain typical spore characteristics, i.e. the Y-mark and in one species, *V. rotatus* (100), a roundly triangular outline. *Vittatina* also retains the Y-mark and possibly derives from *Vestigisporites rudis* (93) which in certain specimens displays a reticulation that is roughly aligned to form striae. *Pityosporites* could readily be derived from *Vittatina multistriata* (102) or possibly directly from a species of *Vestigisporites. Lueckisporites asulcus* (124) and *L. nyakapendensis* (125) link with *Pityosporites amplus* (121) to form a SAMC in two separate assemblages, i.e. OW 1148'/1145' and OW 94'.

5.4.3 Specific relationships

Vestigisporites: 9 Karoo species (15 populations from 5 assemblages). Of all the assemblages studied, HKr yielded by far the most diverse and well preserved populations. Seven of the nine species occur in this assemblage and together form a SAMC. The two remaining species, *V. ventrisaccatus* (92) and *V. walikalensis* (97) combine with these to form a MAMC. It is possible that all or some of the seven species from HKr constitute one or more compound populations: it would require an elaborate multivariate analysis of the material to determine whether or not this is so. For the present, the species have been recorded according to the assumption that they are represented by separate populations with a certain amount of hybridization linking them.

At any rate the nine species are clearly closely related and there seems to be no justification for including them in more than one genus.

Considering the evidence for Gondwanaland as a whole, it appears that virtually the full diversification within the genus was attained prior to the deposition of the Dwyka Tillite and its equivalents, or at the latest within the period of their deposition. *V. rotatus* (100), is perhaps the only exception, having evolved from *V. gondwanensis* (99) somewhere about the middle of the Lower Ecca. The genus and its closest relatives made their first prominent appearance in the uppermost part of the Carboniferous in both Gondwanaland and Euramerica (Anderson 1973, p. 69 - 70, see notes on *Potonieisporites*).

Vittatina: 9 Karoo species (22 populations from 10 assemblages).

Only four of the nine species, i.e. *V. multistriata* (102), *V. nonsaccata* (103), *V. simplex* (104) and *V. fasciolata* (108) form a MAMC. The remaining five species all remain somewhat distinct. *Vittatina* is a complex genus and many arguments will undoubtedly be levelled regarding the diverse array of species that have been included within it. In the accompanying sketches (Fig. 5) an attempt has been made to interpret the arrangement of the various morphological features. Based on these interpretations and the known stratigraphic ranges in Gondwanaland the phylogenetic relationships between the various species have been estimated (Chart 4). *V. multistriata* (102) is the most variable of the species and appears to be the basic form from which all the others have evolved. *V. fasciolata* (108) and *V. triradiata* (109) were the first to split off from this basic stock and each could possibly merit separate generic status. They are, however, considering all the available morphological features, still remarkably similar to the group as a whole, and it seems inadvisable to separate them at this stage. *V. nonsaccata* (103) was the next to split off and from this form were later derived the three closely related species *V. lucifera* (105), *V. magma* (106) and *V. densa* (107), followed by *V. simplex* (104). *V. circumsaccata* (101) is an independent short lived line derived directly from *V. multistriata* (102).

Pityosporites: 14 Karoo species (24 populations from 6 assemblages). Good, well preserved populations of *Pityosporites* are rarely encountered in the Karoo Basin. Only the four assemblages, HKr, OW 1148'/1145', OW 94' and Kb produced good material.

From the data available from the four mentioned assemblages it appears that all 14 species are very closely related and there seems to be no justification for including them in more than one genus. Twelve of the 14 species form a MAMC. Only minor morphological breaks render the remaining two species distinct from this continuum.

As is the case with *Vestigisporites,* all seven species of *Pityosporites* occurring in assemblage HKr form a SAMC and a multivariate analysis of the material would be required to determine more accurately the true relationships within this group. The species have been recorded according to the assumption that they are represented by separate populations with a certain amount of hybridization binding them. The same situation arises for certain of the species (as indicated on Chart 5) in assemblages OW 94' and Kb.

Lueckisporites: 5 Species (12 populations from 7 assemblages). By far the best populations encountered in the Karoo Basin derived from the two assemblages SAP 6 1017'/1000' and OW 94'. *L. asulcus* (124) and *L. nyakapendensis* (125) constitute compound populations in three different assemblages. In two of these they link with *L. welkomensis* (126) to form a SAMC. A slight morphological break separates *L. hannonicus* (127) from the continuum. *L. neohannonicus* (128) is more distinct, but still clearly related to the genus.

5.4.4 Generic descriptions

VESTIGISPORITES Balme & Henn. '55

TYPE SPECIES	*Vestigisporites rudis* Balme & Henn. '55, pl. 6 (54); designated by Hart '60, p. 13.
DESCRIPTION	
Overall grain	
Size	50(82)114 to 124(172)220.
Shape	Elongately oval (5 species), to broadly oval (3 species), to circular (3 species), to very roundly triangular (3 species).
Y-mark	Monolete (5 species), to monolete/trilete (3 species), to trilete (6 species).
a : b	1:10 to 10:10
Bladder attachment	Displaced slightly dorsally (1 species), symmetrical equatorial (3 species), displaced strongly ventrally (1 species), not clear (9 species).
Exoexine (outer sheath)	
Texture	Fine (3 species), to coarse (11 species).
Radial pleating	Weak (5 species), to medium (4 species), to strong (5 species).

Intexine (inner body)	
Dehiscence	None (11 species), to weak (1 species), to strong (2 species).
Folding	Weak (2 species), to medium (1 species), to strong (8 species), or not clear (3 species).
Ornament	Levigate (9 species), intrareticulate (1 species), or intrareticulate to verrucate (4 species).

VITTATINA Luber ex Jansonius '62

TYPE SPECIES	*Vittatina subsuccata* Samoilovich '53; designated by Jansonius '62.
DESCRIPTION	
Overall grain	
Size	20(44)54 to 68(94)118.
Shape	Elongate oval (3 species), to oval (5 species), to circular (4 species).
Y-mark	Monolete (11 species), to trilete (1 species); the Y-mark adorns the dorsal surface of the corpus (all species) and is in addition, sometimes clearly reproduced on the cappa (especially in *V. triradiata*).
Exoexine (outer sheath)	
Cappa - dorsal	Strongly to very weakly intrareticulate (9 species), or with no intrareticulation (3 species); corresponding development, in inverse proportion, of partially to very clearly defined longitudinal ribs - 4 per 20 μm (2 species), 6 to 7 per 20 μm (4 species), 9 to 11 per 20 μm (6 species).
-ventral	Cappa restricted to dorsal surface (4 species), encroaches to occupy outer perimeter of ventral surface (1 species), or occupies almost all of ventral surface (7 species).
Cappula	Narrow transverse (7 species), or occupying all or nearly all of ventral face (5 species).
Sacci	Nonsaccate (9 species), disaccate (1 species), monosaccate (2 species).
Intexine (inner body)	
Corpus-shape	Follows closely the shape and size of the exoexine (excluding that part which may be extruded to form sacs).
-preserv.	Inner body and outer sheath frequently found partially or entirely dissociated (3 species), or not found dissociated (8 species).

PITYOSPORITES Sew. '14

TYPE SPECIES	? Not designated to date.
DESCRIPTION	
Overall grain	
Size	24(32)40 to 100(120)136.
Shape	Elongate oval (9 species), to oval (5 species), to broadly oval (2 species).
Y-mark	No sign of any Y-mark except in some rare varieties of *P. amplus*.
Exoexine (outer sheath)	
Cappa-dorsal	Non striate (9 species), non striate to weakly striate (1 species), or striate (6 species); striate forms generally with 3 to 5 ribs per 20 μm (4 species), but reaching 8 per 20 μm (1 species), or with only a single central striation (1 species); ribs generally longitudinal, but in 1 species frequently oblique and in 2 species sometimes broken by weak to strong intrareticulation.
-ventral	Cappa never extends onto ventral surface.
Cappula	Sacci generally meet laterally and ventrally leaving simply a linear joint (14 species), or more rarely a parallel sided cappula ± 10 to 15 μm broad occurs (2 species).
Sacci	Disaccate; haploxylonoid (6 species), to slightly diploxylonoid (5 species), to diploxylonoid (3 species); to strongly diploxylonoid (2 species); sacci 3/4 x (5 species), to 1 x (5 species), to $1^1/_2$ x (3 species), to 2 x (2 species), to >2 x (1 species) corpus; slight distal inclination (15 species), to medium distal inclination (1 species).
Intexine (inner body)	
Corpus-shape	Circular to broadly longitudinally or transversely oval.
-preserv.	Development of strong transverse terminal folds (8 species), strong transverse medial folds (5 species), variable from 1 type to the other (2 species), or with no folds (1 species).

LUECKISPORITES Pot. & Klaus '54

TYPE SPECIES	*Lueckisporites virkkiae* Pot. & Klaus '54, pl. 10(3), p, 534; original designation.
DESCRIPTION	
Overall grain	
Size	34(50)60 to 68(100)116.
Shape	Elongate oval (2 species), to oval (3 species), to circular (2 species).
Y-mark	None.
Exoexine (outer sheath)	
Cappa-dorsal	Distinct; traverses 3/5 length of grain (3 species), to 4/5 length of grain (2 species), to almost full length of grain (1 species), to full length of grain and extending down either end to partially

FIG. 5 Vittatina

Simplified reconstructions of the external morphology of the 9 species described from the Karoo Basin.

- (i) The sketches are simplified in that the intrareticulate ornamentation occurring to a varying degree in most of the species has been generally omitted.
- (ii) The sketches represent the idealized norm.
- (iii) Scale: 500 x

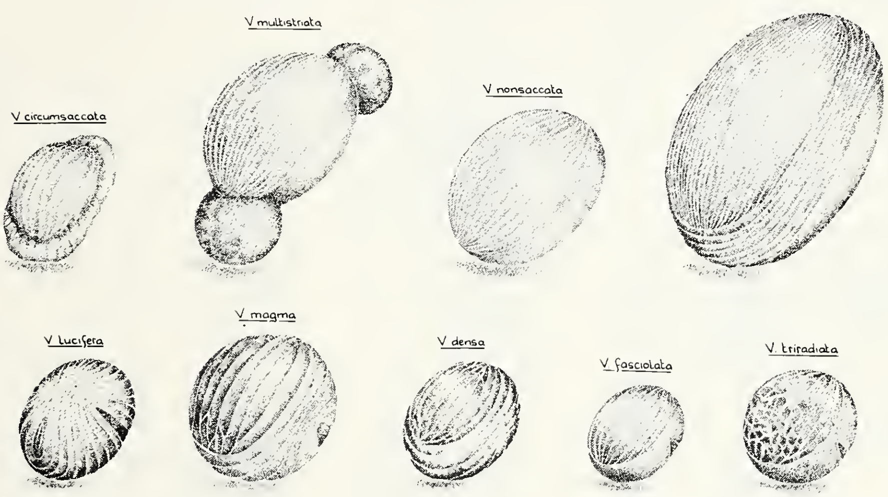


FIG. 6 Lueckisporites

Reconstructions of the external morphology of the 5 species described from the Karoo Basin.

- (i) The sketches represent the idealized norm.
- (ii) Scale: 500 x

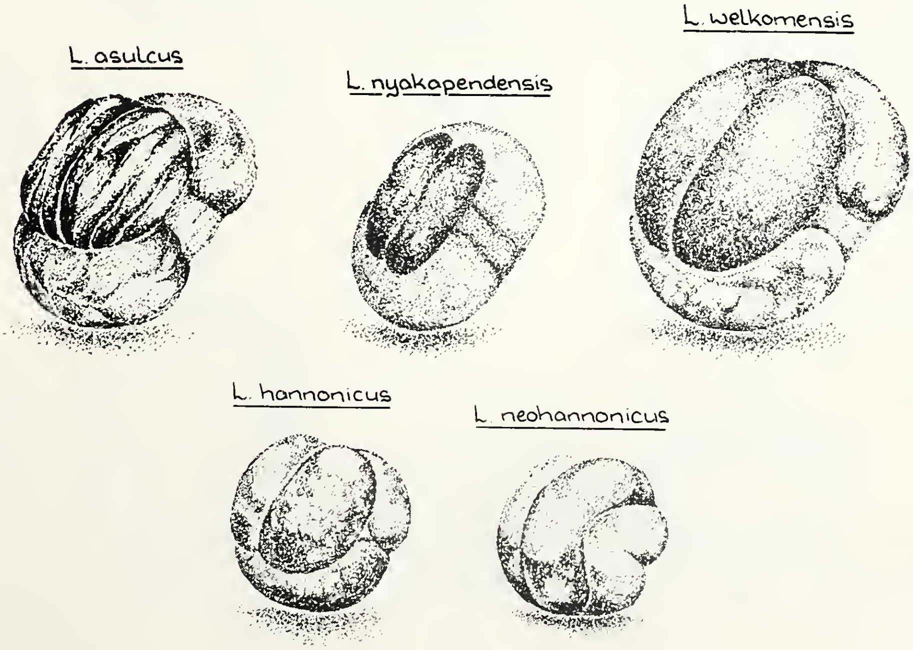


FIG.7 Pityosporites

Schematic illustrations of the 14 species described from the Karoo Basin

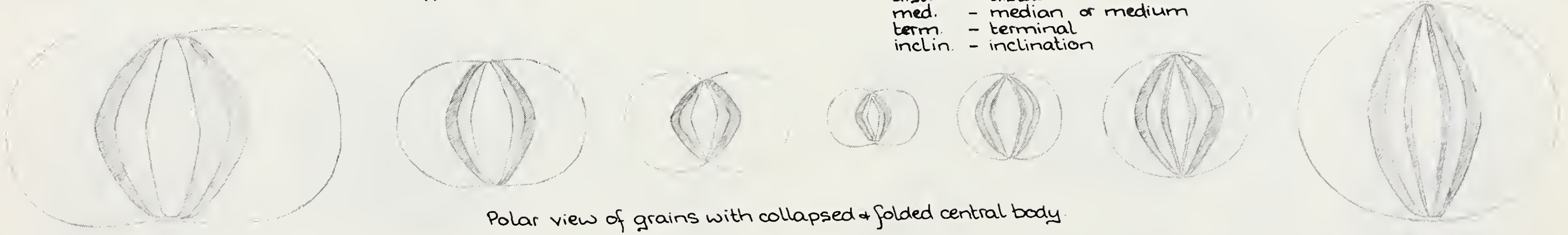
(i) The aim is to depict schematically the 8 variable characters on which the species have been differentiated.

(ii) The sketches represent the idealized norm.

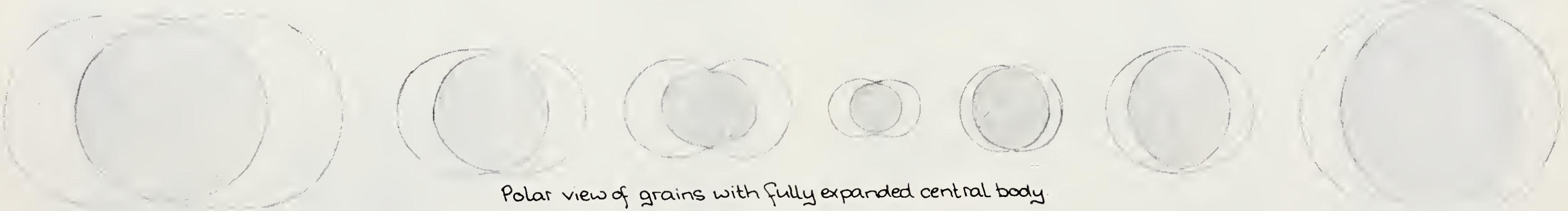
(iii) Scale : 500 x

Abbreviations:

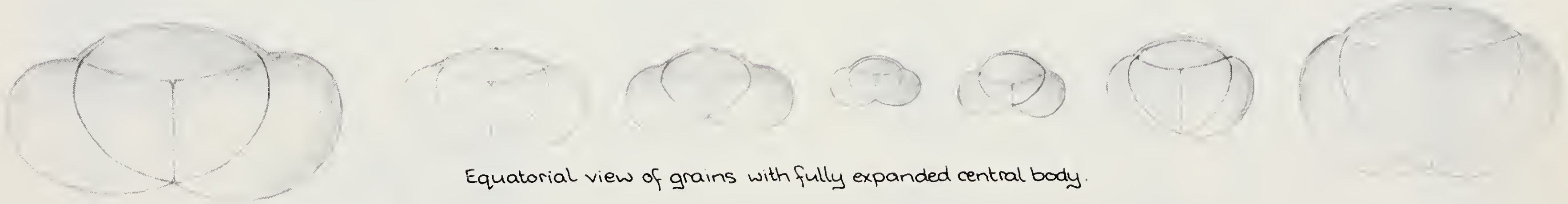
sl.	- slight(ly)
str.	- strong(ly) or striate
haplox.	- haploxylonoid
diplox.	- diploxylonoid
dist.	- distal
med.	- median or medium
term.	- terminal
inclin.	- inclination



Polar view of grains with collapsed & folded central body.



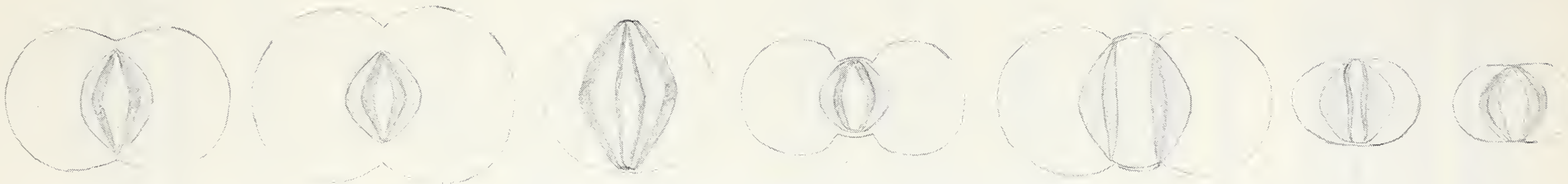
Polar view of grains with fully expanded central body



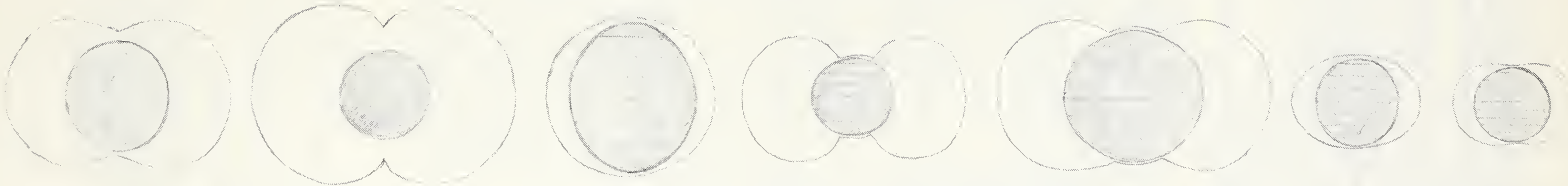
Equatorial view of grains with fully expanded central body.

	Pityosporites nectus	P. triassicus	P. nucleoparvus	P. indarraensis	P. tenuicorpus	P. ovatus	P. maximus
Size -	100 (120) 136	48 (68) 80	50 (60) 84	24 (32) 40	26 (36) 46	32 (53) 74	68 (94) 120
Shape -	elongate oval	elongate oval	elongate oval	elongate oval	oval	broadly oval	broadly oval
Cappa -	non-striate	non-striate	non-striate	non-striate	non-striate	non-striate	non-striate
Cappula -	linear joint	linear joint	linear joint	linear joint	linear joint	linear joint	linear joint
Sacci	sl. diplox. 1 x corpus sl. dist. inclin.	sl. diplox. 1 x corpus sl. dist. inclin.	diplox. 1½ x corpus sl. dist. inclin.	sl. diplox. 1 x corpus sl. dist. inclin.	sl. diplox. ¾ x corpus med. dist. inclin.	haplox. ¾ x corpus sl. dist. inclin.	haplox. ¾ x corpus sl. dist. inclin.
Corpus -	str. term. folds	str. term. folds	str. term. folds	str. term. folds	str. term. folds	str. term. folds	str. term. & med. folds

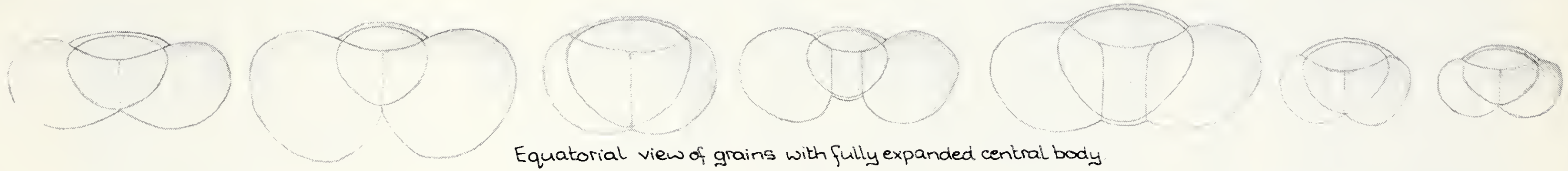
FIG.7 **Pityosporites** (continued)



Polar view of grains with collapsed + folded central body.



Polar view of grains with fully expanded central body.



Equatorial view of grains with fully expanded central body

P. levis	P. fusus	P. goraiensis	P. cancellatus	P. amplus	P. micros	P. varimicros
72(82)92	82(97)112	32(62)92	42(80)98	46(100)120	40(47)54	40(44)48
elongate oval	elongate oval	broadly oval	elongate oval	elongate oval	oval	elongate oval
non-striate	non-striate to weakly str	str (3 per 20 µm)	str. (5 per 20 µm)	str. (3 to 4 per 20 µm)	str (5 per 20 µm)	str. (8 per 20 µm)
linear joint	linear joint	linear joint	10 µm broad	15 µm broad	linear joint	linear joint
diplox.	str. diplox.	haplox.	str. diplox.	diplox.	haplox.	sl. diplox
1½ x corpus	>2x corpus	¾ x corpus	2x corpus	1x corpus	¾ x corpus	1x corpus
sl. dist. inclin.	sl. dist. inclin.	sl. dist. inclin.	sl. dist. inclin.	sl. dist. inclin.	sl. dist. inclin.	sl. dist. inclin.
str. med. folds	str. med. folds	str. term. folds	str. med. folds	str. med. folds	str. med folds	str. term. folds

	occupy the ventral surface (1 species); striate (3 per 20 μm) (1 species), or non-striate (6 species), but always with a prominent central cleft dividing the cappa into 2 broad ribs.
-ventral	Cappa restricted to the dorsal surface (6 species), or extending down either end to partially occupy ventral surface (1 species).
Cappula	Roughly rectangular in side and ventral view (ranging from ± 8 μm broad near the equator to ± 14 μm at the ventral pole) (4 species), or reduced to a linear cleft between the two sacci (2 species), or transitional between these two groups (1 species).
Sacci	Disaccate (6 species), or sacci reduced to broad ribs identical in appearance (size, shape and texture) to the cappa ribs (1 species); slightly diploxylonoid (5 species) to haploxylonoid (2 species); Saccus 1 x (4 species), to 2 x (3 species) cappa rib; slight (5 species), to medium (1 species), to strong (1 species) distal inclination.
Intexine (inner body)	
Corpus-shape	Oval (5 species), to circular (2 species).
-preserv.	Indistinct or lost (5 species), to distinct unfolded never lost (1 species), to completely enclosed and hidden by sacci and cappa ribs (1 species).

5.5 CONIFEROPHYTA, CYCADOPHYTA, GINKGOPHYTA

The miospores discussed here are tentatively assigned to the Coniferophyta, Cycadophyta and Ginkgophyta although some, or even most, could be of other origin (see 5.5.1). In the Gondwana Permian literature 14 genera and 22 species of miospore belonging to this group have been described to date. In the present revision eight genera and 11 species (three genera and five species of which are known from the northern Karoo) are recognized. The revised list of taxa is set out in Table 12 for which further explanation is given in Chapter 4.3a.

5.5.1 Botanical affinities

In no instance in the Gondwana Permian have any of the grains included in this section been isolated from pollen bearing organs. However, broadly similar forms are produced by extant Cycadophyta, Coniferophyta, Ginkgophyta and Gnetophyta.

5.5.2 Generic distinctions

The three genera included in this section are fully distinct from one another.

5.5.3 Specific relationships

Gnetaceaepollenites: 3 Karoo species (9 populations from 6 assemblages).

The three species are not linked in a morphological continuum, but are clearly closely related.

Cycadopites and *Pinuspollenites:* These two genera are each represented by single species in the Karoo Basin, and are covered by three and one populations respectively.

TABLE 12 - *Coniferophyta, Cycadophyta, Ginkgophyta etc.:* revised list of Gondwana Permian genera and species

Cycadopites cymbatus (Balme & Henn. '56) Hart '65	129
Pinuspollenites thoracatus Balme '70	130
Klausipollenites schaubergeri (Pot. & Klaus) Balme '70	Balme '70, *pl. 16(1-5);* Balme '73, pl. 1(7).
Cedripites priscus Balme '70	Balme '70, *pl. 20(1-4);* Helby '70, pl. 38(6-23); Segr. '69, pl. 6(F).
Polarisaccites bilateralis Ybert & Marq. '70	Bharad. '69, pl. 1(30), pl. 2(36); Ybert & Marq. '70, *pl. 1-4 (in full).*
Gnetaceaepollenites sinuosus (Balme & Henn. '56) Bharad. '62	131
Gnetaceaepollenites ovatus sp. nov.	132
Gnetaceaepollenites sp.A.	Glick. '72, *pl. 41(1, 2,* 3, 4); Balme '73, pl. 1(11).
Gnetaceaepollenites bulbiger sp. nov.	133
Bascanisporites undosus Balme & Henn. '56b.	Balme & Henn. '56b, *pl. 10(81,* 82, 83); Hill & Woods '63, pl. 15 (8); Balme & Playf. '67, pl. 2(5); Helby '70, pl. 28(78); Glick. '72, pl. 23(1-10); Balme '73, pl. 1(14).
Densipollenites pullus Segr. '69	Bharad. '62, pl. 6 (99-104), pl. 7(105); Bharad. & Sal.'64, pl. 4(73, 76); Balme & Playf. '67, pl. 2(9); Segr. '69, *pl. 4(A, B), pl. 5(B, C);* Glick. '72, pl. 21(1-7), pl. 22(1-4); Segr. '72, pl. 6(8); Balme '73, pl. 1(19).

5.5.4 Generic descriptions

CYCADOPITES Wodehouse ex Wilson & Webster '46

TYPE SPECIES	*Cycadopites follicularis* Wilson & Webster '46, fig. 7, p. 274; original monotypy.
DESCRIPTION	
General	Non-saccate, non-striate, monocolpate grains.
Size	60(66)72.
Shape	Elongate oval with somewhat pointed ends (in fully intact specimens) to oval or circular (in distended specimens).
Distal furrow	Extends full length of grain; formed by conspicuous invagination of exine; margins of furrow closed in intact specimens, open initially towards the ends in partly distended specimens.
Exine	± 1μm thick, intragranulate.

PINUSPOLLENITES Raatz '37

TYPE SPECIES	*Pinuspollenites labdacus* Potonié; original monotypy.
DESCRIPTION	
General	Non-striate, disaccate grains.
Size	46(51)56.
Shape	Elongate oval.
Exoexine	Relatively thick-walled cappa merges gradually with a relatively thin-walled broad cappula; Sacci more or less haploxylonoid, with a medium to strong distal inclination.
Intexine	Corpus ± circular, frequently lost.

GNETACEAEPOLLENITES Thiergart '58

TYPE SPECIES	*Gnetaceaepollenites ellipticus* Thiergart '58; original monotypy.
DESCRIPTION	
Exine	Apparently single layered.
Shape	Elongate oval (1 species), oval to elongate oval (1 species), oval (2 species).
Longit. folds and ridges	Very prominent (3 species) to less prominent (1 species).
? Germinal markings	Monolete, monolete to partially trilete, or obscured.
Ornament	Arrangement: elements consistent, evenly scattered throughout. Description: ? very densely and finely foveolate (3 species), to coarsely gemmate (1 species).
Size	53 to 82(134)186.

CHAPTER 6

The microfloral succession: conclusions and discussion

6.1 MICROFLORAL ZONATION OF NORTHERN KAROO PERMIAN

Correlation of strata within the northern Karoo Permian is considerably enhanced by the application of palynology. Other fossil groups are rare and of very limited use in this regard. Good macrofloral remains are restricted to a limited number of isolated localities in widely separated horizons, i.e. in the Lower Ecca, Middle Ecca, and the Daptocephalus Zone of the Beaufort. Useful vertebrate remains are confined to the Daptocephalus Zone. A few isolated specimens of mollusc (marine and non-marine) have been found in the Middle Ecca. In the absence of palynology, therefore, correlation is virtually entirely dependent on lithology, palaeogeography and tectonics. Dolerite dykes and sills are common through much of the area, and have destroyed, through devolatilization, a significant proportion of the originally preserved miospore material. Well preserved assemblages are nevertheless sufficiently frequently encountered to be of great value.

Based on the microfloral suites encountered in the 53 assemblages selected through the northern Karoo Permian sequence (including the Cistecephalus Zone of the southern Karoo), 21 microfloral stages (assemblage biozones) are recognized. These stages are grouped into 7 zones and 18 sub-zones which have for interim convenience been taken to coincide, in the relevant reference areas, with the lithostratigraphic units of 'formation' and 'member' rank respectively. It is felt that it would be premature to define the zone and subzone boundaries in terms of reference points/boundary stratotypes (Hedberg 1972) until such time as a more comprehensive succession of assemblages has been studied.

On a regional basis much of the northern Karoo Permian succession, that is from the base of the Dwyka Tillite to the top of the Tapinocephalus Zone equivalent, appears to represent an essentially unbroken depositional sequence. The Dwyka Tillite represents deposition from the repeated advance and retreat of valley glaciers. After the final retreat and melting of the presumed ice cap to the north a clear transgressive (L.Ecca) - regressive (M. Ecca), - transgressive (U. Ecca) - regressive (Tapinocephalus Zone equivalent) sequence occurs.

The most obvious microfloral break occurs between the Dwyka and the Lower Ecca. In no borehole studied has a set of samples spanning this boundary yielded assemblages, however, so the degree of coincidence between the lithostratigraphic and biostratigraphic changes at this transition remains undetermined. The microflora, through the remainder of the unbroken sequence reveals a continuum of change. Above the Tapinocephalus Zone equivalent, where intervals of non-deposition are prominent, the strata have been subdivided most successfully to date on the basis of vertebrate zonation. The microfloral and vertebrate zone boundaries are, in the absence of information to the contrary, taken to coincide.

The lithostratigraphic succession varies considerably within the northern Karoo region with the 'formation' boundaries often being demonstrably diachronous. In no one area are the most complete and/or typical sequence of 'formations' and 'members' found to succeed one another. The zonation scheme is based therefore on the study of assemblages from several distinct areas. The following reference areas are nominated for the seven zones:

Zone 1 (Dwyka): The well developed palaeo-valley glacial sequence occurring in the Welkom/Virginia area (20).
Zone 2 (Lower Ecca): Varied lithologies from the Ladybrand borehole (19) the Welkom/Virginia area (21) and the Sasolburg area (22).
Zone 3 (Middle Ecca): The coal measure deposits of the Greylingstad/Bethal/Hendrina area (23).
Zone 4 (Upper Ecca): The delta front to relatively deep shelf deposits of the Welkom/Virginia area (20, 21).
Zone 5 (Tapinocephalus Zone equivalent): The near shore fluvial and fluvio-deltaic deposits of the Welkom/Virginia area (20, 21).
Zone 6 (Cistecephalus Zone): The tetrapod vertebrate bearing flood-plain deposits of the Graaff-Reinet area (6).
Zone 7 (Daptocephalus Zone): The tetrapod vertebrate and macroflora bearing flood-plain deposits of the Bergville/Harrismith area (27).

TABLE 13 - Northern Karoo: microfloral diversity per 'formation'

Microfloral Zones	'Formation'	Total number of species per zone	Average number of species per assemblage
	Lystrosaurus Zone	?	?
Zone 7	Daptocephalus Zone	18	17
Zone 6	Cistecephalus Zone	10	.10
Zone 5	Tapinocephalus Zone equivalent	55	33
Zone 4	Upper Ecca	61	28
Zone 3	Middle Ecca	105	42
Zone 2	Lower Ecca	77	32
Zone 1	Dwyka	31	21

Microfloral diversity varies considerably through the northern Karoo Permian sequence (see Table 13). Species numbers are impoverished in the Dwyka, increase significantly reaching a peak in the Middle Ecca, then decline again to reach their lowest figures in the Cistecephalus and Daptochephalus Zones of the Beaufort. These figures quite probably reflect fluctuating floral diversity in and around the depositional areas. The most characteristic miospores of the 7 zones and/or 18 sub-zones are listed with percentage abundance data in Tables 15-20. A key to these tables is given in Table 14.

TABLE 14 - Key to Tables 15 - 20

+	Indicates that the species occurs in the preceding or succeeding zone.
•	By virtue of the known range in the northern Karoo region the species is presumed to occur but has not been recorded in the assemblages studied.
(space)	The species has not yet made its first appearance, or no longer occurs in the northern Karoo region (subject to further data).
5 or 0,05	Average percentage frequency of the species in the assemblages studied.

Zone 1 (Dwyka)

Reference area and assemblages

Welkom/Virginia area (20); borehole UC 729; 2 assemblages.

Additional area and assemblages

Standerton area (24); borehole UC 608; 2 assemblages.

Lithostratigraphic limits (reference area)

Zone 1 is taken to include the full glacial sequence from the basement to the top of the last massive diamictite or varved siltstone horizon. Above this a transition zone generally comprising silty sandstones or sandy siltstones with regularly to sparsely scattered boulders (dropstones) occurs. This transitional section is here included as the lower part of the Lower Ecca.

Miospore characteristics

Total diversity of species	31
Average diversity per sample	21
No. of first appearances in zone	?
No. of last appearances in zone	4
No. of species restricted to zone	?

Microfloristic boundaries

The microfloristic assemblages of Zone 1 are strongly contrasted from those of Zone 2. The break is characterized primarily by the first appearance of 24 species in Zone 2(a) and by a distinct decrease in percentage occurrence of the seven most significant Dwyka species (listed in Table 15) across the boundary. Only four of the 31 Dwyka species fail to extend into younger strata.

Sub-zones

A consideration of the four assemblages studied (these are well scattered through the succession) suggests that the microfloras remained more or less unchanged through the Dwyka. No division into sub-zones can be effected.

Characteristic species

The group of seven species in Table 15, with their relatively high frequency of occurrence when compared with post Dwyka microfloras, are particularly valuable in fingerprinting Dwyka assemblages.

TABLE 15 - Characteristic miospores of Zone 1 (based on all four assemblages studied)

Species	Average percentage abundance per assemblage
Zinjisporites spinosus (20)	4
Microbaculispora tentula (41)	41
Pachytriletes densus (65)	0,25
Punctatisporites gretensis (69)	12
Vestigisporites balmei (95)	2
Vestigisporites gondwanensis (99)	15
Cycadopites cymbatus (129)	0,50

Palaeogeography and lithology

In the northern Karoo Basin, Dwyka deposits are preserved primarily in generally south trending Dwyka age glacial valleys. In the interfluve areas little or no Dwyka deposits are preserved. The two boreholes studied here intersect two such valley sequences. These valleys were gouged out by glacial activity and filled by coarse to fine grained glacial debris to depths of 100 m or more. Several advances and retreats of the glaciers are evident from the repetitive occurrence of tillites, grits, sandstones and siltstones. The siltstones (of various tones of grey) are frequently varved indicating seasonal deposition. They are presumed to have been deposited in shallow, fresh water glacial lakes of restricted extent, during periods of glacial retreat (Anderson, A, 1974).

General palaeontology

The fossil content of the northern Karoo Dwyka is restricted almost entirely to microfloras. The siltstones generally yield badly broken and abraded miospores. The four assemblages studied here were sufficiently well preserved for percentage counts of the species to be made. No well preserved macrofloras of unequivocal Dwyka age have been recorded from the northern Karoo. Vertebrate and invertebrate remains are unknown. However, it is clear from the numerous well preserved trackways occurring on the bedding planes of the varved siltstones that arthropods flourished in the glacial lakes (Anderson, A, 1974).

Correlation

In the northern Karoo Basin assemblages of Dwyka age have been studied only from areas 20 and 24. The significantly thinner tillite sections in areas 22 and 23 are presumed to be of generally equivalent age.

The Dwyka Tillite of the southern Karoo Basin is difficult to correlate with respect to the northern Karoo. The evidence (see text 6.2), inconclusive as it is, indicates that the lower portion of the southern tillites may be of Carboniferous age, whilst the bulk of the section equates better with the lower portions of the northern Lower Ecca than with the northern Dwyka.

Zone 2 (Lower Ecca)

Reference areas and assemblages

(a) Welkom/Virginia area (21); borehole SAP 6; 2 assemblages (sub-zones 2a and 2c).

(b) Sasolburg area (22); borehole P13; 1 assemblage (sub-zone 2b).

(c) Ladybrand area (19); borehole LA; 4 assemblages (sub-zone 2d).

Lithostratigraphic limits

The four sub-zones cannot be usefully defined according to lithological limits on the presently available data. Zone 2 (as a whole) must be defined separately for each of the three reference areas.

Area 19 - The full siltstone section from the base of the Karoo sediments to the base of the first massive Middle Ecca sandstone.

Area 21 - The grits, carbonaceous shales and thin coal seams from the top of the Dwyka Tillites to the base of the first massive Middle Ecca sandstone.

Area 22 - The grits, carbonaceous shales and thin coal seams from the top of the Dwyka Tillites to the base of the 'no. 2 coal seam'.

Miospore characteristics

Total diversity of species	77
Average diversity per sample	32
No. of first appearances in lowest sub-zone	24
No. of first appearances throughout zone	52
No. of last appearances throughout zone	10
No. of last appearances in highest sub-zone	3
No. of species restricted to zone	7

Microfloristic boundaries

The microfloral break at the Dwyka-Lower Ecca boundary is very marked (see notes under Zone 1). The boundary with the Middle Ecca is however transitional, the youngest Lower Ecca sub-zone being more closely related microfloristically to the Middle Ecca than to the earlier sub-zones of the Lower Ecca. In particular the species (with percentage occurrences) within the genera *Vittatina* and *Pityosporites* indicate this relationship.

Sub-zones

The microfloral sequence through the Lower Ecca cannot be established from any single coherent area. Based on the assemblages studied, from three different areas, four distinctive sub-zones can be recognized.

Assemblages SAP 6 1152'9"/1151'3" and SAP 6 1133'/1130' (area 21) are clearly intermediate in character between Dwyka and Middle Ecca microfloras and at the same time reflect two definite stages in microfloral development. Assemblage P 13 154, 35/152, 95 (area 22) falls between the two SAP 6 assemblages in development, whilst the four LA assemblages (area 19) which represent a single indivisible sub-zone, fall clearly between the younger SAP 6 assemblage and Zone 3a of the Middle Ecca. Further study from these three areas and from further areas would be necessary to test the comprehensiveness and validity of the four sub-zones.

The group of species in Table 16 are the most significant in characterizing the four sub-zones.

Palaeogeography and lithology

The Lower Ecca sediments attain their most typical and fullest development in the central Karoo where thick accumulations (up to 425 m in area 25) of fine grained pro-delta and shelf deposits occur. These sediments, primarily siltstones, thin out towards the northern margins of the basin grading into sandstones and sandy siltstones and finally into grits, carbonaceous shales and thin coal seams deposited under fluviatile and swampy near shore conditions.

TABLE 16 - Characteristic miospores of the sub-zones of Zone 2
(based on all seven assemblages studied)

Zones	1	2				3
		a	b	c	d	
Mehlisphaeridium irregulare (3)				0,01	0,01	+
Maculatasporites indicus (7)				1	0,01	
Pilasporites (2 species) (12, 13)		5	0,05	0,50	.	+
Zinjisporites spinosus (20)	+	7	.	.	.	+
Gondisporites (punctatus and parvus) (21,22)		61	.	0,50	2	+
Gondisporites raniganjensis (24)				14	0,50	+
Gondisporites braziliensis (25)				19	9	+
Acanthotriletes (5 species) (31-36)	+		.	8	3	+
Microbaculispora eoericiana (50)		1	0,05			
Microbaculispora plumsteadi (55)		4	36	0,02	0,05	
Microbaculispora lageniformis (56)				0,02	0,05	+
Microbaculispora paramicronodosa (57)				0,02	.	+
Pachytriletes densus (65)	+	0,02	.	0,01		
Apiculatisporis (6 species) (81-86)	+	0,02	0,50	10	1	+
Polypodiisporites detritus (87)		0,01	.	0,01	4	+
Vittatina multistriata (102)	+	0,02	.	0,02	0,25	+
Vittatina lucifera (105)					0,02	+
Vittatina triradiata (109)		0,01	0,01	0,05	4	+
Pityosporites (7 species) (111, 114-116, 120-122)	+	0,50	3	0,50	61	+
Cycadopites cymbatus (129)	+	0,50				

General palaeontology

The grey siltstones of the pro-delta and shelf deposits (area 19) contain abundant though generally badly broken and distorted miospores. The carbonaceous shales of the near shore swamp deposits (areas 21 and 22) yield abundant well preserved spores, though fairly poorly preserved pollen grains. In these same deposits well preserved lycopod megaspores and cuticular stem remains abound. The lycopod remains described by Plumstead (1966, 1967, 1969) from material from shafts and numerous boreholes from the Welkom/Virginia area (area 20, 21) derive from these horizons. Since the deposits yielded an exclusively lycopod macroflora and since the specimens were considered closely comparable with lycopod species from the Witteberg Series of the Cape and the Australian Devonian, the beds were taken to be of Devonian age. However, the strata yield a diverse microflora, which is distinctly more advanced than that of the Dwyka and is quite demonstrably of Permian age.

No faunal remains are known from the Lower Ecca of the northern Karoo region.

Correlation

Based on the study of microfloras together with a consideration of lithology, correlation of the northern Karoo Zone 2 deposits can be effected as shown on Charts 1 and 2. In line with the arguments put forward in 6.2, equivalently aged strata in the southern Karoo appear to include the bulk of the Dwyka Tillites and the lower two thirds of the upper Dwyka Shales.

Zone 3 (Middle Ecca)

Reference area and assemblages

Greylingstad/Bethal/Hendrina area (23); boreholes WV3, UC621, G172 and A401; 10 assemblages.

Additional assemblages

Welkom/Virginia area (21); boreholes OW and SAP 6;4 assemblages. Sasolburg area (22); borehole P13; 3 assemblages. Springbok Flats (36); surface locality HKr; 1 assemblage.

Lithostratigraphic limits (reference area)

Zone 3 (general): Taken to extend from the base of the 'No. 2 coal seam' to the base of the '± 10 m siltstone horizon' near the top of the Middle Ecca section. It must be noted that Zone 3 does not fully coincide with the lithostratigraphically defined Middle Ecca, which in the reference area would include the full extent of the predominantly sandy sequence from the top of the tillites (or the basement if no tillites occur) to the extant topographic surface. The lithostratigraphic equivalents of the Lower Ecca and Upper Ecca are not encountered in area 23.

Sub-zone 3a: Base of 'No. 2 coal seam' to base of 'No. 4 coal seam'.
Sub-zone 3b: Base of 'No. 4 coal seam' to base of 'No. 5 coal seam'.
Sub-zone 3c: Base of 'No. 5 coal seam' to base of '± 10 m bedded siltstone/sandstone horizon'.
Sub-zone 3d: Base of '± 10 m bedded siltstone/sandstone horizon' to base of '± 10 m siltstone horizon'.

Miospore characteristics (all areas)

Total diversity of species	105
Average diversity per sample	42
No. of first appearances in lower sub-zone	6
No. of first appearances throughout zone	38
No. of last appearances throughout zone	43
No. of last appearances in highest sub-zone	12
No. of species restricted to zone	21

Microfloristic boundaries

With respect to microfloras the lower boundary of Zone 3 is not sharply contrasted with Zone 2. Zone 2d as noted earlier displays obviously closer affinity to Zone 3a than to Zone 2c. The upper boundary is, however, very distinct and marked by a pronounced decline in species diversity particulary within the genera *Microbaculispora, Vestigisporites* and *Vittatina.*

Sub-zones

A sufficient scope of microfloral development occurs within the Middle Ecca (Zone 3) enabling four sub-zones to be recognized. The changes are best expressed in the group of 24 species listed in Table 17.

Palaeogeography and lithology

The Middle Ecca (lithostratigraphic) attains its most complete development in the Vryheid area (31) where a 425 m section comprising a single major clearly defined regressive-transgressive cycle, from delta-front through delta to fluviatile with coal swamps and back through delta to delta-front, is encountered. This and other fully developed sections falling within or near the souteastern corner of the project area are unfortunately heavily intruded by dolerites rendering microfloral investigations particularly unfruitful.

In the Greylingstad/Bethal/Hendrina area (23) the regressive-transgressive cycle still holds, but is not as clearly developed as in the Vryheid area (31). The greater part of the succession (which reaches some 200 m) consists of well developed fluviatile/coal swamp deposits whilst the deltaic sequences above and below are less developed. The succession is remarkably uniform throughout the area with a series of marker horizons making lithostratigraphic correlation very effective. The succession is primarily sandy, but includes a number of grits, silty horizons (in some cases bioturbated), coal seams, carbonaceous shales, and glauconitic beds.

In the Sasolburg area (22), the sequence though stunted is similar to that in area 23. In the Welkom/Virginia area (20, 21) the Middle Ecca is still less well developed. The Middle Ecca thins out southwards towards the deeper portions of the basin and becomes finer grained (e.g. borehole LA, area 19), eventually wedging out completely within the central Karoo region.

General palaeontology

Most grey coloured siltstones and carbonaceous shales within the Middle Ecca yield miospores, but generally they are poorly preserved (broken and distorted), particularly the pollen grains. Of the approximately 200 samples (fine grained carbonaceous sediments unaffected by dolerites) collected and processed from the reference area (area 23) only 10 assemblages yielded microfloras really suitable for further detailed analysis, and in only four of these were the microfloras particularly well preserved and therefore broadly suitable for photographic documentation.

Although fragmentary macrofloral remains are frequently encountered, localities with well preserved leaf assemblages are uncommon. Only six such localities have been systematically sampled to date (BPI collection).

A brief review of the sparse faunal remains of the Middle Ecca has been compiled by McLachlan

TABLE 17 - Characteristic miospores of the sub-zones of Zone 3
(based solely on the reference material, i.e. the 10 assemblages from area 23)

Zones	2	3				4
		a	b	c	d	
Mehlisphaeridium parvum (1)				0,01	0,02	+
Mehlisphaeridium fibratum (4)				0,01	0,01	+
Microbaculispora tentula (41)	+	7	3	3	0,25	+
Microbaculispora trisina (46)				0,20	0,05	+
Microbaculispora gondwanensis (47)				0,10	2	+
Microbaculispora irregularis (54)				0,01		
Microbaculispora capilliformis (60)				0,01		
Apiculatisporis diversiformis (81)	+	0,50	0,01	0,10	0,05	+
Apiculatisporis levis (84)	+	1	.	0,01		
Apiculatisporis bulliensis (85)	+	1	.	0,01	.	+
Apiculatisporis cornutus (86)	+	0,50	.	.	.	+
Vestigisporites rudis (93)	+	1	1	0,05	.	+
Vittatina nonsaccata (103)			0,05	0,05	0,05	
Vittatina simplex (104)	+	0,01	0,01	0,05		
Pityosporites levis (117)			2	1		
Pityosporites fusus (118)		0,02	1	0,50		
Pityosporites goraiensis (119)				4	4	+
Lueckisporites asulcus (124)				0,50	5	+
Lueckisporites nyakapendensis (125)				0,05	5	+
Lueckisporites welkomensis (126)				0,01		
Lueckisporites hannonicus (127)			0,01	0,01	0,50	+
Gnetaceaepollenites sinuosus (131)			0,10	0,20	0,50	+
Gnetaceaepollenites ovatus (132)				0,02		
Gnetaceaepollenites bulbiger (133)				0,01	0,02	+

(1973). Fish scales occur abundantly in a carbonaceous shale horizon lying closely above the glauconitic horizon in the Sasolburg area (22). Other isolated records of faunas from various areas include similar fish scales, a single specimen of conchostrachan, a few specimens of bivalves, a single specimen of a possible nautiloid cephalopod, and fragments of amphibian and reptilian bones from nodules from a single locality.

Arthropod trails have not been recorded to date (Anderson, A, 1974).

Correlation

Eight assemblages, additional to those from the reference area, from 3 areas have been studied. Comparison of these assemblages with the microfloral suites of the 4 Middle Ecca sub-zones from the reference area enables correlation with fair to good confidence in 6 of the 8 cases -

HKr (area 36) - most likely falls in sub-zone 3b (possibly high in the sub-zone).
P13 147,70/146,80 and P13 140,60 (area 22) - clearly falls in sub-zone 3a.
P13 128,13/126,50 (area 22) - clearly falls in sub-zone 3b.
OW 1257' (area 20, 21) - falls fairly well in sub-zone 3a.
OW 1156'/1145' (area 20, 21) - clearly falls in sub-zone 3c.
OW 1171' (area 20, 21) - has not been included on Chart 3 (see 4.1, first paragraph) but from a cursory examination appears to fall in sub-zone 3b.
SAP 6 1019'/1000' - is clearly of Zone 3 age but is difficult to place in one of the sub-zones. However, since its microfloral spectrum is essentially different from that of OW 1156'/1145' and, since it almost certainly lies stratigraphically higher than that assemblage, it is taken here to fall in sub-zone 3d.

The Middle Ecca correlations as depicted on Chart 2 are based on the above conclusions.

Correlation of assemblages between the northern and southern Karoo regions is far less obvious (see 6.2). From the microfloral data available, however, it would appear that Zone 3 equivalents in the southern Karoo region include the upper third of the Upper Dwyka Shales, the White Band and the lowest part of the Ecca Shales.

Zone 4 (Upper Ecca)

Reference area and assemblages

Welkom/Virginia area (21); boreholes SAP 6 and SAP 7; 16 assemblages.

Lithostratigraphic limits

Taken to include the full siltstone section from the top of the well bedded siltstone/sandstone horizon (resting on the Middle Ecca sandstones) to the base of the first massive Beaufort sandstone.

Since the entire zone comprises siltstones, the five sub-zones cannot be closely defined with respect to lithology. The siltstones are, however, coarsest and most carbonaceous towards the top and bottom of the sequence, whilst becoming progressively finer and less carbonaceous towards the middle. Sub-zone 4c thus coincides roughly with the finest silts, 4a and 4e with the coarsest silts and 4b and 4d with the intermediate silts.

Miospore characteristics

Total diversity of species	61
Average diversity per sample	28
No. of first appearances in lowest sub-zone	0
No. of first appearances throughout zone	6
No. of last appearances throughout zone	16
No. of last appearances in highest sub-zone	4
No. of species restricted to zone	2

Microfloristic boundaries

The lower boundary with Zone 3 is distinct as noted earlier. No clear break occurs, however, between Zone 4 and Zone 5 microfloras.

Sub-zones

Based on the microfloras studied from the reference area, Zone 4 can be clearly sub-divided into 5 sub-zones. Their identity is best illustrated by the group of 21 species listed in Table 18.

Palaeogeography, lithology and correlation

The Upper Ecca of the northern Karoo is well developed across the south central part of the region i.e. between the Welkom/Virginia area (20, 21) and the Bergville/Harrismith area (27). In the reference area (20, 21) the 220 m sequence consists of a single clearly defined transgressive-regressive cycle, from delta-front through pro-delta to relatively deep shelf deposits and back through pro-delta to delta-front. The whole is an unbroken sequence of siltstones as described briefly above.

Towards the northern margins of the basin the Upper Ecca siltstones wedge out rapidly and are in part possibly represented by coarse sands and grits (e.g. in borehole UC 678 of area 23).

General palaeontology

The Upper Ecca siltstones in the reference area yield abundant microfloras throughout the sequence. They are almost invariably poorly preserved, presumably from deterioration sustained in transit over the relatively long distances between their source and the site of accumulation. Only in a few instances are populations from these assemblages represented in the photographic catalogue, but reasonably successful percentage counts can be made.

No other fossil groups are represented in the Upper Ecca of the northern Karoo region.

Zone 5 (Tapinocephalus Zone Equivalent)

Reference area and assemblages

Welkom/Virginia area (20, 21); borehole OW; 5 assemblages.

Lithostratigraphic limits

Taken to include the full alternating sandstone and siltstone sequence from the base of the first massive Beaufort sandstone to the extant topographic surface. The sub-zones cannot be lithologically defined.

TABLE 18 - Characteristic miospores of the sub-zones of Zone 4
(based on the reference material, i.e. the 16 assemblages from area 20, 21)

Zones	3	4					5
		a	b	c	d	e	
Gondisporites punctatus (21)	+	65	0,02	.	0,01	0,02	+
Gondisporites parvus (22)	+	1	1	.	.	0,02	+
Gondisporites braziliensis (25)	+	2	0,02	.	.	.	+
Gondisporites variabilis (29)	+	0,02	1	1	2	0,05	
Gondisporites splendens (30)	+	0,05	3	3	7	1	+
Microbaculispora labyrinthica (36)	+	.	.	.	5		
Microbaculispora directa (40)	+	2	4	0,10	4	1	
Microbaculispora finegranulata (42)	+	.	.	.	2		
Microbaculispora mediogranulata (43)	+	.	.	.	2	0,50	+
Microbaculispora micronodosa (45)	+	.	0,01	0,10	1	0,10	+
Microbaculispora trisina (46)	+	.	0,10	0,05	5	0,05	+
Microbaculispora gondwanensis (47)	+	.	.	.	3	0,05	
Microbaculispora villosa (48)					4		
Microbaculispora ericiana (49)					1	.	+
Dulhuntyispora dulhuntyi (64)					1		
Polypodiisporites detritus (87)	+	.	3	3	1	1	+
Vittatina lucifera (105)	+	.	0,05	0,10	0,20	1	+
Lueckisporites asulcus (124)	+	0,10	1	20	12	15	+
Lueckisporites nyakapendensis (125)	+	0,10	1	20	12	15	+
Lueckisporites hannonicus (127)	+	0,05	0,10	2	.	1	
Lueckisporites neohannonicus (128)				2	.	1	+

Miospore characteristics

Total diversity of species	55
Average diversity per sample	33
No. of first appearances in lowest sub-zone	2
No. of first appearances throughout zone	7
No. of last appearances throughout zone	40
No. of last appearances in highest sub-zone	16
No. of species restricted to zone	6

Microfloristic boundaries

As mentioned earlier, the microfloral boundary with Zone 4 is transitional. The boundary with Zone 6 on the other hand is very distinct. As many as 40 of the 55 Zone 5 species fail to continue through into the higher zone. A dramatic decrease in the percentage occurrence of *Vittatina* accompanied by an almost equally large increase in abundance of *Pityosporites* also characterize the boundary.

Sub-zones

Zone 5 is notable in that it represents a period during which major floral changes and readjustments occurred. 31 long-lived Karoo Permian species appear to die out at one or other stage during this period. The eight species in Table 19 show either a progressive decline or incline in abundance through the succession. Steady progressive changes in the microfloras rather than clear disjunctions, characterize Zone 5. Division into readily definable sub-zones cannot, therefore, be achieved. However, due to the obvious significance of the changes, five sub-zones each based on one of the assemblages studied, have been erected.

Palaeogeography, lithology, palaeontology and correlation (refer to Map 1)

The Tapinocephalus Zone attains its fullest and most typical development in the south-western Karoo Basin in the general region of the KW and SA boreholes (areas 10 and 11). Here over 2 000 m of sediments are encountered in places and consist of an alternation of dark blue, blue grey and greenish siltstones (purple varieties are subordinate but fairly common) and blue to buff sandstones (Kitching, 1972). In these areas tetrapod vertebrate remains have been recovered from numerous localities. Beyond the fairly restricted area shown on Map 1, no vertebrates indicative of this zone have been recorded. However, an examination of the lithostratigraphic sequences intersected in the southern and central Karoo boreholes suggests that the zone extends eastwards and north-eastwards roughly as indicated on Map 1. The 90 m sequence of alternating sandstones and grey siltstones directly overlying the Upper Ecca in the Welkom/Virginia area (20, 21) is considered here to be a northern extension of the Tapinocephalus Zone. No marked microfloral change occurs at the boundary between the Upper Ecca siltstones and this 90 m sequence, suggesting that no significant time interval interrupts the succession. The equivalence in age suggested between north and south Karoo cannot be palynologically tested at the present time. Only a few very poorly preserved carbonized miospores of no stratigraphic value have been isolated from a single horizon from the vertebrate bearing Tapinocephalus Zone of the southern Karoo (Horowitz, pers. comm. 1975).

The sediments of Zone 5 (area 20, 21) appear to represent near shore fluvial and fluvio-deltaic deposits.

The grey siltstones yield abundant miospores which are generally poorly preserved. One assemblage (OW 94') yielded excellently preserved material. Fragmentary macrofloral remains also occur.

TABLE 19 - Characteristic miospores of the sub-zones of Zone 5 (based on the reference material, i.e. the 5 assemblages from area 20, 21)

Zones	4	5					6
		a	b	c	d	e	
Cyclogranisporites bhardwaji (75)	+	0,10	1	1	2	5	+
Vittatina lucifera (105)	+	1	8	9	25	11	+
Vittatina magma (106)	+	0,10	0,10	0,10	2	49	+
Vittatina densa (107)				0,10	0,10	0,50	
Pityosporites maximus (116)	+	13	12	16	4	1	
Lueckisporites asulcus (124)	+	15	8	2	2	0,50	
Lueckisporites nyakapendensis (125)	+	15	8	2	2	0,20	
Lueckisporites neohannonicus (128)	+	0,10	0,20	3	4	0,50	+

Zone 6 (Cistecephalus Zone)

Reference area and assemblages

Graaff Reinet area (6); surface locality GrR; 1 assemblage.

Lithostratigraphic limits (reference area)

Coincides with the limits of the Cistecephalus Zone as described by Kitching (1972).

Miospore characteristics

Total diversity of species	10
Average diversity per sample	10
No. of species appearing in zone	0
No. of species disappearing in zone	1
No. of species restricted to zone	0

Microfloristic boundaries

A very marked floral break distinguishes Zone 6 from Zone 5 (discussed earlier). The microfloras of Zone 6 and Zone 7 are on the other hand generally similar. No new species arise in Zone 6 (or 7) whereas a considerable proportion of long lived Karoo Permian species disappear during or at the close of Zone 5. This leaves Zone 6 (and 7) with a dearth of species. The microfloral distinction between Zones 6 and 7 are best expressed in terms of the differing proportions of the more commonly occurring species (see Table 20). These proportions are subject to review with the study of a broader collection of assemblages.

TABLE 20 - Characteristic miospores of Zones 6 and 7 (based on the reference material)

Zones	6	7
Inaperturosporites inapertus (78)	10	0,05
Apiculatisporis bulliensis (85)	1	0,10
Apiculatisporis cornutus (86)	2	
Vittatina lucifera (105)	3	1
Pityosporites ovatus (115)	3	1
Pityosporites goraiensis (119)	14	4
Pityosporites amplus (121)	4	65
Pityosporites micros (122)	60	25

Palaeogeography, lithology, palaeontology and correlation

The Cistecephalus Zone reaches its maximum development of over 300 m in the region of the KA, VR and CR boreholes (areas 4, 5 and 7) in the southern Karoo. The sediments consist of grey green, bluish green and purple siltstones interbedded with lenticular sandstones. Tetrapod vertebrate remains are common (Kitching, 1972). The vertebrate bearing strata are unknown in the northern Karoo, nor do there appear to be developed any equivalently aged strata of different facies. For a knowledge of the microfloral suite from this zone, sampling must therefore be undertaken in the central and southern Karoo regions. The sediments are generally unsuitable for the preservation of miospores but with imaginative sampling a fairly comprehensive notion of the microflora might eventually be gained. No such concerted effort has been attempted during this study and only one assemblage has been recovered - surface locality GrR (area 6). The assemblage consisting of more or less intact although fairly highly carbonized specimens, derived from a lens of grey siltstones bearing numerous specimens of fresh water lamellibranch. In general the depositional environment of all the Beaufort zones was that of an extensive flood plain traversed by shifting braided and meandering river systems and dotted with shallow transient lakes and pans (Kitching, 1972). The climatic conditions and current velocities would have varied through the geographic and stratigraphic extent of the evolving basin complex.

Zone 7 (Daptocephalus Zone)

Reference area and assemblages

Bergville/Harrismith area (27); surface localities Kb and LKf; 2 assemblages.

Lithostratigraphic limits (reference area)

Coincides with the limits of the Daptocephalus Zone as described by Kitching (1972).

Miospore characteristics

Total diversity of species	18
Average diversity per sample	17
No. of species appearing in zone	0
No. of species disappearing in zone	?
No. of species restricted to zone	0

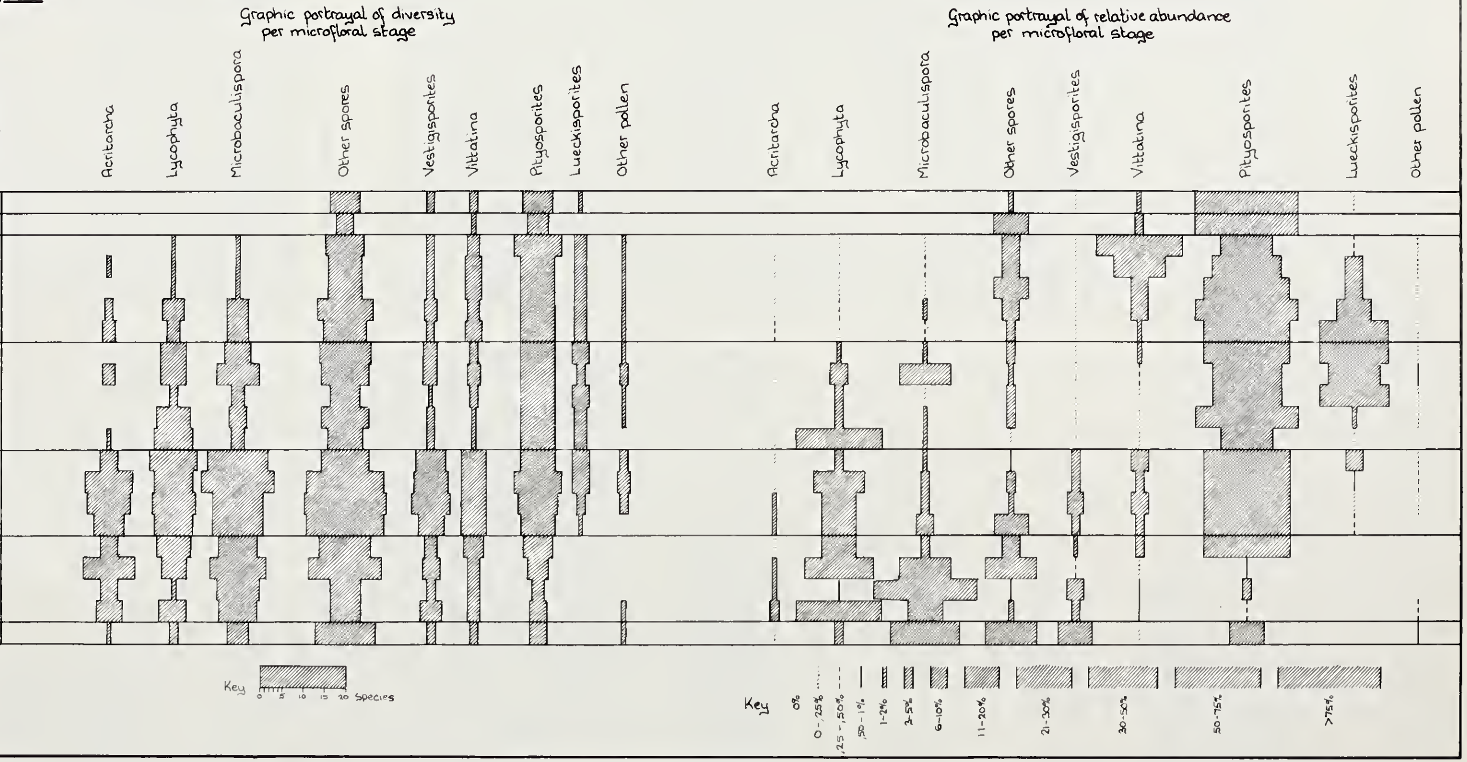
Microfloristic boundaries

As stated earlier Zones 7 and 6 are essentially similar and differ primarily in the proportions of

FIG.8 Miospore characteristics of northern Karoo palynological zones.

Zones & sub-zones	Major genera & other groups of miospores	Acritarcha	Lycophyta	Microbaculispora	Other spores	Vestigisporites	Vittatina	Pityosporites	Lueckisporites	Other pollen
7	/	/	/	/	7	2	2	7	1	/
6	/	/	/	/	4	/	1	5	/	/
5	e	1	1	1	9	2	3	11	3	1
	d	1	1	4	8	2	4	8	3	1
	c	/	1	2	8	2	4	8	3	1
	b	2	5	5	13	3	3	8	3	1
	a	3	3	5	10	2	4	8	3	1
4	e	/	6	6	12	3	2	8	4	1
	d	3	6	10	11	3	3	8	2	2
	c	/	2	3	7	1	2	8	4	1
	b	/	8	4	11	2	1	8	3	1
	a	1	9	3	8	2	1	8	3	/
3	d	4	11	14	11	7	6	8	4	2
	c	11	9	17	18	8	6	11	4	3
	b	10	10	12	19	9	6	9	2	2
	a	7	9	12	18	6	6	8	1	/
2	d	4	8	9	12	3	5	7	/	/
	c	12	6	13	17	4	3	5	/	/
	b	4	1	10	7	2	3	3	/	/
	a	6	6	9	7	5	3	4	/	1
1	/	1	2	5	14	2	2	4	/	1

← No of species per microfloral stage →



their more common species (see Table 20). The nature of the relationship of the microflora of the Daptocephalus Zone with that of the succeeding Lystrosaurus Zone is unknown. The Lystrosaurus Zone, being lithologically unsuitable for microfloral studies, has received no attention to date.

Palaeogeography, lithology, palaeontology and correlation

The typical strata of this zone reach a thickness of some 350 m to the north and north-east of areas 6 and 7 in the southern Karoo. The sections consist of bluish-grey, green-grey and grey siltstones (with subordinate though fairly common development of red and purple siltstones), interbedded with lenticular sandstones of variable thickness (Kitching, 1972). Tetrapod remains are common. In the area extending south from Memel (area 29, near the Natal-Transvaal border) along the outcrop to Bulwer (between areas 25 and 26, near the Natal-Cape border) the zone displays a significantly different character in that it here yields both tetrapod and excellently preserved macrofloral (predominantly leaf) remains. The sections in this region reach 600 m in thickness with the sediments being generally similar to those in the southern Karoo, but without the development of red and purple siltstones and with the additional minor occurrences of carbonaceous shale and coal lenses. Macrofloral assemblages have been collected from 16 localities throughout this region (Benecke, 1975). A few of these localities also yield well preserved though rare insect remains - primarily wing impressions. Ten of the most promising localities have been sampled for microfloras but unfortunately they have in most cases been severely carbonized due to the ubiquitous dolerites. Only two, Kb and Lkf (both of which fall within the northern Karoo region), occur far enough removed from dolerites such as to yield useful microfloral assemblages. These are the only two Daptocephalus Zone localities incorporated in the present study. Kb yielded excellently preserved material, but Lkf only fair material.

Lystrosaurus Zone (Middle Beaufort)

This zone is of possible uppermost Permian or lowermost Triassic age (Anderson & Anderson, 1970). It reaches its maximum development of 1 400 m in the southern Karoo, thins to between 300 and 400 m in the northern Karoo and consists throughout of tetrapod bearing strata. These strata comprise alternations of light grey-green to light bluish-green and bright coloured reddish-maroon and purple siltstones and lenticular beds of sandstones of variable thickness. The red-maroon and purple siltstones and the sandstones are distinctly more prominent than in the lower three zones of the Beaufort (Kitching, 1972). The typical sediments of this zone do not yield microfloras and no concerted effort has been made to locate lenses of more promising sediments, with the result that no microfloral assemblages representing the Lystrosaurus Zone are incorporated in the present study.

6.2 MICROFLORAL ZONATION OF SOUTHERN KAROO PERMIAN

Of the 42 assemblages examined, 21 derive from siltstones intercalated in the Dwyka Tillites; 14 from the Upper Dwyka Shales; and seven from the Ecca Shales (see borehole logs, Fig. 9). The samples all comprise siltstones of varying grain size and tones of grey. The miospores in these assemblages are all fairly highly carbonized but are generally identifiable. A reasonably representative set of assemblages has been examined through the Dwyka Tillite and Upper Dwyka Shale sections (excluding the White Band). Four microfloral stages (assemblage biozones) can be recognized in each. The composition of the assemblages and stages in terms of species and percentage abundances are distinctly different from those of the northern Karoo, which renders correlations particularly difficult. About 10 of the southern Karoo species have not yet been recorded from the northern Karoo, whilst numerous northern species remain unrecorded from the south. These differences must be due either to the very different sedimentary facies or to differing patterns of plant colonization in the neighbouring areas of exposed land. The microfloral suites, including all identifiable miospores, occurring in each stage are given in Fig. 9. There follows a brief discussion of each stage and its possible time relationship with respect to the northern Karoo sequence.

Stage 1 (lowest portion of the Dwyka Tillites)

This stage is distinct and very problematical. It consists solely of acritarchs and spores (pollen grains being absent). *Micrhystridium,* of which four species can be recognized, is perhaps the most common constituent, suggesting marine conditions. The micrhystridia are insufficiently known to be of stratigraphic value. Lycophyte spores are also common but are poorly preserved and cannot be positively identified. If they are correctly identified as *Zinjisporites spinosus* (20) and *Gondisporites punctatus* (21) correlation with Zone 2a (or possibly Zone 1) of the north would be suggested. The remaining species are of no value in correlation. A number of possibilities present themselves:

(a) That the stage is of Carboniferous age (witness the absence of pollen grains) and that a considerable time gap separates it from stage 2.

(b) That the stage is of Permian age and that the miospores are all reworked from older deposits.

(c) That the assemblage is very strongly facies controlled and the absence of pollen grains is not of significance as regards age.

The first alternative is possibly the most feasible. It is substantiated by the general history of late Palaeozoic glaciation in Gondwanaland, where minor glacial phases evidently occurred during the Carboniferous both in South America and eastern

Australia prior to the onset of the ubiquitous Lower Permian glacial epoch (Anderson, 1973, p. 72).

Stages 2, 3 and 4 (greater part of the Dwyka Tillites)

These stages are dominated by striate pollen grains, with monosaccates being less common, and spores other than *Inaperturosporites* being conspicuously rare. Besides *Vestigisporites,* none of the characteristic commonly occurring species of the northern Karoo Dwyka are encountered. The common occurrence of *Vittatina fasciolata* (108) in stage 4 is possibly of significance. In the north this species occurs most commonly in Zone 2a and b of the Lower Ecca. Correlation of stages 2, 3 and 4 with the northern Dwyka is thus not readily apparent. On balance the microfloral evidence suggests correlation rather with Zone 2a and b of the northern Lower Ecca. Such a correlation is certainly not unequivocal, but has been applied in Chart 1 more to stimulate discussion than through positive conviction.

Stage 5 (Lower third of Upper Dwyka Shales)

At or near the contact between the Tillites and the Upper Dwyka Shales a number of spore species appear for the first time, such that the assemblages now become characterized equally by spores and pollen grains. Most significant is the fairly common occurrence of the spores *Gondisporites raniganjensis* (24), *Gondisporites braziliensis* (25), *Acanthotriletes* spp. and *Apiculatisporis bulliensis* (85); and the first appearance of *Pityosporites cancellatus* (120). Correlation with Zone 2c of the Lower Ecca is strongly suggested.

Stage 6 (Middle third of Upper Dwyka Shales)

Vittatina triradiata (109) and *Vittatina lucifera* (105) make their first though rare appearance. The spore diversity is again much reduced. Correlation with Zone 2d of the Lower Ecca is suggested.

Stages 7 and 8 (Upper third of Upper Dwyka Shales)

In stage 7 a number of species make their first appearance. Most significant are *Lueckisporites asulcus* (124) and *Vittatina simplex* (104). A further important feature is the common occurrence of *Vittatina triradiata* (109) in both stages 7 and 8. Of note is the fairly common occurrence of a species of *Micrhystridium* which might indicate marine influence and possible correlation with the richly glauconitic horizon in zone 3b of the Middle Ecca in which *Micrhystridium karooense* (18) occurs. In any event, correlation of stages 7 and 8 is probably best achieved with Zone 3 (a and b) of the Middle Ecca. This would equate by inference the White Band (which is difficult to recognize in borehole cores, but was probably not incorporated in the sampling of AB 1/65) with Zone 3 (c or d) of the Middle Ecca.

The Ecca samples from borehole KL 1/65

The seven assemblages examined from approximately the middle portion of the Ecca shales are strongly dominated by pollen grains, spores being virtually absent. The suite of miospores present (Table 21) suggests correlation most closely with Zone 4c of the middle part of the Upper Ecca of the northern Karoo.

TABLE 21 - Species encountered in the Ecca shales of KL 1/65

Circulisporites venosus (9)	*
Acanthotriletes (levigate form) (31)	*
Inaperturosporites sp.	*
Vittatina multistriata (102)	**
Vittatina lucifera (105)	*
Vittatina triradiata (109)	**
Pityosporites tenuicorpus (114)	**
Pityosporites ovatus (115)	*
Pityosporites maximus (116)	**
Pityosporites cancellatus (120)	*
Pityosporites amplus (121)	**
Lueckisporites asulcus (124)	***
Lueckisporites nyakapendensis (125)	***
Lueckisporites hannonicus (127)	**

(* = rare; ** = common; *** = abundant)

6.3 MIOSPORE DISTRIBUTION PATTERNS WITHIN THE GONDWANA PERMIAN

The GSAD pattern for the Gondwana Permian of each of the 133 species of miospores recognized in the northern Karoo Permian has been plotted on the 'species pages'. These plots are based on all available information which, although far from comprehensive, enables embryonic patterns of distribution to be discerned and tentative interpretations to be made. The reliability of the GSAD patterns will improve with the growth of a bank of miospore 'populations' documented from all productive formations and regions within the Gondwana Permian; the development of a stable, widely applied scheme of taxonomy and nomenclature; improved reliability and resolution in inter-regional correlation of Permian strata.

The following comments are offered regarding the distribution patterns as they presently appear:

(a) The GSAD pattern of each species is unique. The degree of success of the species with respect to relative abundance, geographic spread through Gondwanaland and persistence through time varies considerably.

(b) Some 25 of the 203 Gondwana Permian species are found to occur throughout or virtually throughout, the super-continent. On the other extreme some 70 species are known to date from only one basin or from closely adjacent basins. Among the remaining species the full spectrum between the two extremes is found.

If the suite of species found in one particular basin during a relatively narrow time limit is compared with those from presumed equivalent

Stages	①	②	③	④	⑤	⑥	⑦	⑧
Micrhystridium sp.1,2,3,4	✓✓✓	✓						
cf. Mehlisphaeridium gondwanensis (5)	✓✓							
cf. Zinjisporites spinosus (20)	✓✓✓							
cf. Gondisporites punctatus (21)	✓✓					✓		
Inaperturosporites spp.	✓✓	✓✓✓	✓✓	✓	✓✓		✓	
Apiculatisporis sp.1	✓✓							
Microbaculilispora grandegranulata (44)		✓						
Vestigisporites cf. balmei (95)		✓	✓	✓✓	✓✓			
" gondwanensis (99)		✓✓	✓	✓	✓✓	✓		
Pityosporites (striate sp.1)		✓✓✓	✓✓	✓✓✓	✓✓	✓		
(striate sp.2)			✓✓✓	✓✓✓	✓✓✓	✓	✓	
Vittatina multistriata (102)			✓	✓✓✓	✓✓		✓✓	✓
" fasciolata (108)				✓✓✓	✓✓✓		✓	
Cyclogranisporites spp.				✓	✓✓✓			✓
Gondisporites raniganjensis (24)					✓✓			
" braziliensis (25)					✓✓			
Zinjisporites congoensis (19)					✓✓	✓		
Microbaculispora tentula (41)					✓✓✓	✓✓	✓	
Acanthotriletes spp.					✓✓	✓	✓	✓
Apiculatisporis bulliensis (85)					✓✓			
Pityosporites cancellatus (120)					✓		✓	✓
" amplus (121)					✓		✓	✓
Vittatina triradiata (109)						✓	✓✓✓	✓✓✓
" Lucifera (105)						✓	✓	
Pityosporites micros (122)							✓	✓
" sp.3							✓	✓
Lueckisporites asulcus (124)							✓✓	✓✓
Vittatina simplex (104)							✓	
Michrystridium sp.5							✓✓	
Pilasporites scissus (12)							✓✓	
Acritarcha sp.							✓✓	
Gondisporites splendens (30)					✓		✓	✓

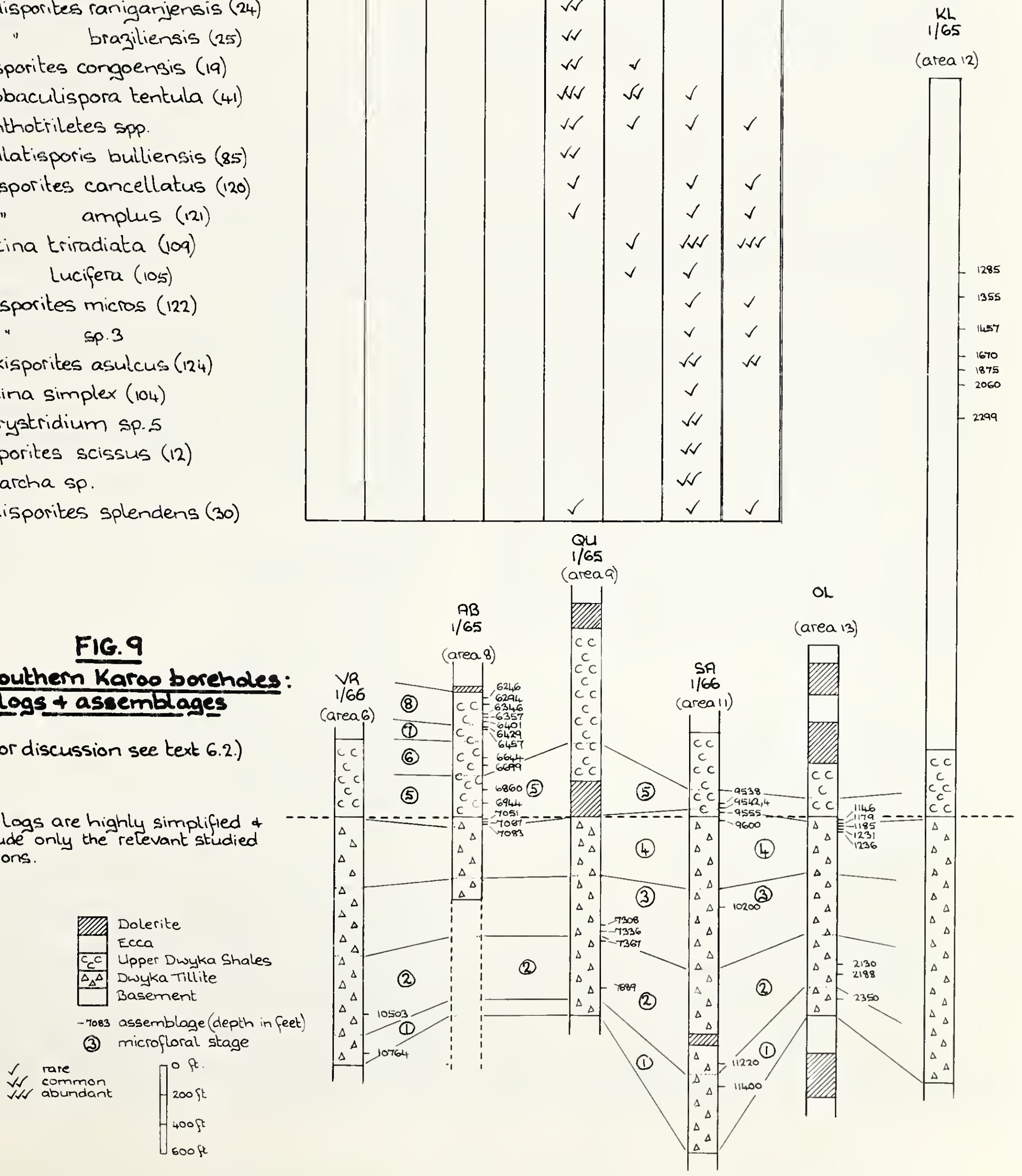


FIG. 9

The southern Karoo boreholes: logs + assemblages

(for discussion see text 6.2.)

The logs are highly simplified & include only the relevant studied sections.

horizons in various other basins a high degree of overlap is witnessed. In the examples given below the four regions considered are those for which the most comprehensive data is presently available.

(i) Of the 105 species found to date from the Middle Ecca of the northern Karoo, 35 are known from equivalent strata in the Congo, 46 from India and 49 from Western Australia.

(ii) Of the 31 species found to date from the Dwyka of the northern Karoo, 12 are known from equivalent strata in the Congo, 14 from India, and 13 from Western Australia.

Further work will undoubtedly show the overlap to be greater than is at present apparent. Thus it might be concluded that at any particular time the floras associated with any two distantly separated depositional basins in Gondwanaland would have incorporated at least a 50% overlap of species.

(c) The following figures give an indication of the stratigraphic ranges through the Gondwana Permian of the 133 species found in the northern Karoo.

36 species range through less than ¼ of the Permian period
17 species range through between ¼ and ½ of the Permian period
34 species range through between ½ and ¾ of the Permian period
46 species range through greater than ¾ of the Permian period

In summary, well over half of the 133 species are found to exhibit a stratigraphic range extending through more than half the 45 million years of the Permian.

(d) As a consequence of the variable SAD pattern displayed by any particular species from one primary region to another, due caution must be exercized in attempts at inter-region stratigraphic correlation based on the comparison of total miospore assemblages. It is clear that those species which occur relatively commonly and which combine wide geographic range with similar SAD patterns area to area are the most reliable in correlation. The following species may be included in this category, and considered as a group (noting absence or presence and relative abundance) will give a good indication of the stratigraphic position of most assemblages.

Microbaculispora tentula (41)
Microbaculispora trisina (46)
Microbaculispora villosa (48)
Microbaculispora ericiana (49)
Microbaculispora pseudoreticulata (51)
Punctatisporites gretensis (69)
Apiculatisporis levis (84)
Laevigatosporites vulgaris (89)
Vestigisporites balmei (95)
Vestigisporites gondwanensis (99)
Vestigisporites rotatus (100)
Vittatina simplex (104)
Vittatina lucifera (105)
Pityosporites cancellatus (120)
Pityosporites amplus (121)
Lueckisporites nyakapendensis (125)
Leuckisporites neohannonicus (128)
Cycadopites cymbatus (129)
Gnetaceaepollenites sinuosus (131)

(e) The region of first appearance in the Gondwana Permian and the direction and rate of colonization is evident in certain species. Likewise, the trend of diachronous extinction region to region can be discerned in some cases. The following species illustrate such patterns:

Cyclogranisporites bhardwaji (75)
Polypodiisporites detritus (87)
Vittatina multistriata (102)
Vittatina lucifera (105)
Vittatina fasciolota (108)
Vittatina triradiata (109)
Pityosporites ovatus (115)
Pityosporites maximus (116)
Pityosporites fusus (118)
Pityosporites cancellatus (120)
Lueckisporites nyakapendensis (125)

In the case of *V. lucifera* (105), for instance, the species first appears in the Congo during Tastubian times from where it evidently spread steadily down to South Africa and hence via Antarctica to the Perth Basin and India, finally reaching the Canning Basin by Roadian times some 15 million years later. It did not appear to colonize beyond Western Australia. *Polypodiisporites detritus* (87) shows a slower rate of colonization. In this case the species makes its earliest appearance at the base of the Lower Ecca (mid Tastubian) in South Africa and from here spread west, north and east. Its earliest appearance in eastern Australia is in the uppermost Permian some 35 to 40 million years after its appearance in South Africa, where it had already disappeared from the scene some 10 to 15 million years earlier.

In all the species cited both colonization and progressive extinction appear to have spread from the southern African region eastwards via Antarctica to Australia.

(f) The following species display particularly interesting patterns of geographic distribution, in that although they colonized large areas of Gondwanaland, distinct limits to their ranges were evidently imposed.

Zinjisporites spinosus (20)
Gondisporites braziliensis (25)
Vittatina simplex (104)
Vittatina lucifera (105)
Vittatina magma (106)
Lueckisporites asulcus (124)
Lueckisporites nyakapendensis (125)
Lueckisporites welkomensis (126)
Lueckisporites hannonicus (127)
Lueckisporites neohannonicus (128)
Dulhuntyispora dulhuntyi (64)
Dulhuntyispora parvithola (Table 10)
Indospora clara (Table 10)
Bascanisporites undosus (Table 12)
Densipollenites pullus (Table 12)

The two lycopod species, *Zinjisporites spinosus* (20) and *Gondisporites brazilliensis* (25) appear not to have spread beyond the southern African and South American regions. The three *Vittatina* species, each with its own unique distribution, are unknown outside southern Africa, India, Western Australia and western Antarctica. The five Karoo Basin *Lueckisporites* species, although occurring widespread elsewhere in Gondwanaland, are unknown in Australia other than for the record of *L. nyakapendensis* (125) in the uppermost Permian of the Sydney Basin. The genus *Dulhuntyisporites* occurs throughout Australia, but elsewhere is virtually unknown, the only such record being that of *D. dulhuntyi* (64) from the upper part of the Upper Ecca in the Welkom/Virginia area of the Karoo Basin. *Indospora clara* occurs widely in Australia and India, but not elsewhere. *Bascanisporites undosus* occurs throughout Australia, but elsewhere only in eastern Antarctica. *Densipollenites pullus* has been recorded only from Australia, India and eastern Antarctica.

(g) A brief survey of some of the more significant SAD patterns displayed by certain species, genera or groups of genera within the five major plant groups follows. The patterns that emerge for the northern Karoo Permian are compared and contrasted with those for the remaining Gondwana Permian. The degree of conformity of these patterns varies considerably.

(i) Acritarcha

Karoo Basin. Taken as a whole the 18 species of this group are rare components in Permian assemblages of the Karoo. An overall, four-fold SAD pattern can be discerned. In the Dwyka only one species *Tetraporina tetragona* (15) is known and is very rare; in the L. and M. Ecca the greatest diversity of forms and abundance occurs; in the U. Ecca and Tapinocephalus Zone equivalent only five species, all carried over from the M. Ecca, are known and are very rare, in higher horizons the group is unknown.

Gondwanaland. Insufficient data is presently available to determine how generally the SAD patterns of the acritarchs discerned in the Karoo Basin applies to Gondwanaland as a whole. In the Perth Basin for which the most comprehensive information is available the pattern is in many respects significantly different. The two species *Circulisporites venosus* (9) and *C. parvus* (11) may be cited in particular. They are both very rare in the Karoo Basin, but very common in the Perth Basin where in addition they extend higher in the stratigraphic sequence.

(ii) Lycophyta

Karoo Basin. In the lower third of the Permian members of the group are frequently dominant. In the middle third (occupied by most of the U. Ecca) only the species *G. variabilis* (29) and *G. splendens* (30) occur commonly. Six species occur, though rarely, in the Tapinocephalus Zone equivalent, whilst in higher Beaufort strata the lycophytes are unknown.

Gondwanaland. The most significant similarities in the SAD patterns between the Karoo Lycophyta and those found elsewhere in Gondwanaland are displayed by the three species *Z. spinosus* (20), *G. raniganjensis* (24), and *G. splendens* (30). *Z. spinosus* (20) known only from southern Africa and South America is everywhere restricted to the lower third of the Permian. *G. raniganjensis* (24), known from southern Africa, India and Australia ranges from the middle part of the L. Ecca and equivalents to the top of the Permian. In southern Africa it is not known above the Tapinocephalus Zone equivalent, but in India and Australia it extends in addition through the upper third of the Permian. *G. splendens* (30) is known from all the Gondwana continents and ranges throughout the Permian. In the Karoo Basin it is not known above the Tapinocephalus Zone equivalent but in the Salt Range and the Canning Basin it occurs commonly in the higher Permian horizons. The remaining nine species found in the Karoo Basin are as yet too little known from the other Gondwana areas for any meaningful points to be assessed regarding their geographic and stratigraphic extent.

(iii) Sphenophyta and Filicophyta

Karoo Basin

The most interesting stratigraphic details are exhibited by the array of species within the genus *Microbaculispora*. *M. tentula* (41) for instance is the most common microfloral element in the Dwyka averaging 40% per assemblage. It diminishes in frequency more or less regularly through the Ecca and is not found in the Beaufort. *M. eoericiana* (50), *M. pseudoreticulata* (51) and related intrareticulately ornamented forms, *M. plumsteadi* (55) and the other forms displaying enlarged ornament elements roughly along the margin of the contact faces, are all relatively short lived species and are restricted primarily to various sections of the L. and M. Ecca. A number of species, most significant of which are the closely related *M. trisina* (46), *M. gondwanensis* (47), *M. villosa* (48) and *M. ericiana* (49), together with the apparently related genus *Dulhuntyispora*, occur very prominently in the Upper Ecca Zone 4d. None of the species of *Microbaculispora* extend higher than the Tapinocephalus Zone equivalent.

The other most significant stratigraphic features exhibited within the group are the prominent occurrence of *Punctatisporites gretensis* (69) in the Dwyka, its somewhat diminished prominence in the lower half of the L. Ecca and its rarity thereafter; and the common occurrence of *Cyclogranisporites bhardwaji* (75) in Zone 4e of the U. Ecca and the Tapinocephalus Zone equivalent.

Gondwanaland

Comparing these results with the data from the rest of Gondwanaland the following remarks can be made. The dominance of *Microbaculispora tentula* (41) in the Dwyka and equivalents elsewhere appears to be more or less ubiquitous. However, in Western Australia at least, this dominance extends as high as the middle of the Permian after which it rapidly tails off. Of the group of 13 species of *Microbaculispora* more or less restricted to the Lower and Middle Ecca, only three are known outside of the Karoo Basin. *M. pseudoreticulata* (51) and *M. naumovae* (52) are widespread forms and occur nearly exclusively in the Lower Permian. Their stratigraphic ranges are, however, somewhat more extensive than is evident in the Karoo Basin. The species *M. trisina* (46), *M.*

gondwanensis (47), *M. villosa* (48) and *M. ericiana* (49), together with *Dulhuntyispora dulhuntyi* (64) occur widely through Gondwanaland with the exception of South America where data is as yet unavailable. They are restricted in stratigraphic extent, as in the Karoo Basin, very nearly exclusively to strata equivalent to the M. Ecca and higher. Their very obvious prominence in Zone 4d of the U. Ecca is not duplicated elsewhere, but in these other areas they invariably extend higher in the sequence. *Punctatisporites gretensis* (69) occurs very widely in Gondwanaland where its SAD patterns seem more or less to coincide with that encountered in the Karoo Basin. The SAD pattern of *Cyclogranisporites bhardwaji* (75) in the Karoo Basin on the other hand, is not duplicated elsewhere in Gondwanaland.

(iv) Glossopteridophyta

Karoo Basin

The genus *Vestigisporites* is very prominent in the Dwyka (17%); less prominent but still regularly common in the L. and M. Ecca (1% to 5%); and thereafter very rare. The stratigraphic range of *V. rotatus* (100) from Zone 2c of the L. Ecca to the top of the U. Ecca appears significant.

The various species of the genus *Vittatina* display interesting SAD patterns. The most significant points are perhaps the rather sudden prominence of *V. lucifera* (105) and *V. magma* (106) in the Tapinocephalus Zone equivalent relative to their rarity in lower horizons; the prominence of *V. triradiata* (109) (averaging 4%) in Zone 2d of the L. Ecca and in the M. Ecca compared to its rarity in lower and higher strata; and the restriction of the occurrence of *V. simplex* (104) to the same horizons in which *V. triradiata* (109) is prominent.

Due to the frequent poor quality of preservation within the genus *Pityosporites* and the consequent difficulties of specific identification not too much reliance can be placed on the details of the SAD patterns of the various species as portrayed on Chart 4. A general four-fold pattern, however, does emerge. In the Dwyka and lower half of the L. Ecca the genus is relatively poorly represented (1% to 15%); in the upper half of the L. Ecca to the top of Zone 4b of the U. Ecca the genus is dominant (generally ± 60%) with the non-striate forms more common than the striate forms; in Zone 4c of the U. Ecca to the top of the Tapinocephalus Zone the genus is less dominant (generally ± 40 - 45%) with the non-striate forms still more common than the striate forms; and in the Cistecephalus and Daptocephalus Zones the genus is very dominant (± 84 - 98%), with the striate forms in almost complete ascendancy over the non-striate forms.

The distribution of *Lueckisporites* with its five species is evidently clearcut and significant. Four of the five species appear for the first time at various stages in the M. Ecca. The fifth species, *L. neohannonicus* (128) makes its first appearance at the base of Zone 4c in the U. Ecca, and is the only species to continue, although rarely, above the Tapinocephalus Zone equivalent. *L. asulcus* (124) and *L. nyakapendensis* (125) are the most prominent miospores encountered in the top three zones of the U. Ecca and both decline steadily through the Tapinocephalus Zone equivalent.

Gondwanaland

The general SAD pattern of the genus *Vestigisporites* as a whole is more or less consistent throughout Gondwanaland. Likewise, wherever it occurs, the range and abundance of *V. rotatus* (100) appears to be much the same as in the Karoo Basin.

Vittatina lucifera (105) displays an interesting distribution pattern. It is restricted primarily to southern Africa and India (and possibly South America, but the necessary data are not available). It occurs only rarely in Australia and Antarctica. Throughout southern Africa and India the species displays a broadly similar SAD pattern, being relativey rare in the middle third of the Permian and prominent in the upper third. In detail, however, the pattern is very variable. *V. magma* (106) is known only from Africa and India, in the various areas of which its stratigraphic range varies considerably. *V. triradiata* (109) is a very widespread species. Only from S.America is it unknown, probably due to lack of data. It occurs throughout the Permian, but the SAD pattern varies considerably in detail from area to area. *V. simplex* (104) is known from Africa, India and Western Australia. It is always rare and the stratigraphic range throughout appears very similar. Its occurrence in the U. Permian in the Perth Basin is possibly due to reworking.

The SAD pattern of *Pityosporites* for Gondwanaland as a whole broadly matches that for the Karoo Basin.

Lueckisporites is primarily restricted to the upper two thirds of the Permian in South America, Southern Africa and India. The details of the SAD patterns for the various species are by no means in common from area to area.

(v) Cycadophyta, Ginkgophyta and Coniferophyta

Karoo Basin

Cycadopites cymbatus (129) is a significant, consistent, though not particularly common element (0,50%) in the Dwyka; it is less common in Zone 2a of the L. Ecca and unknown in higher strata.

Gnetaceaepollenites sinuosus (131) is a consistent, though relatively rare, element in most assemblages from Zone 3b of the M. Ecca to the top of the Tapinocephalus Zone equivalent.

Gondwanaland

Cycadopites cymbatus (129) is very widespread, the only continent from which it is unknown being Antarctica, and is restricted to the lower third of the Permian. In all areas where sufficient data are available, it is most common in the Dwyka equivalents and steadily decreases in abundance upwards. The actual abundance at any time however, varies considerably from area to area.

Gnetaceaepollenites sinuosus (131) is a widely occurring species, unknown only in South America where the necessary data are unavailable. It is restricted almost exclusively to the upper two thirds of the Permian and, other than in the Dzhulfian of the Perth Basin is consistently a relatively rare element. Its regular appearance through to the uppermost part of the Permian is in contrast to its restricted range in the Karoo Basin.

6.4 MICROFLORAL DIVERSITY

In the present work 33 genera and 133 species are recognized from the Permian strata of the northern Karoo Basin. As far as possible all the morphological forms encountered in the 53 selected assemblages, on which the systematic account has been based, have been considered. In the reconnaissance survey of the numerous additional northern Karoo samples processed during the present programme no further clearly distinct forms were encountered. It is thus considered that the described species represent a reasonably comprehensive coverage of the miospores preserved in the northern Karoo Permian sediments. Any additional types encountered with further work, will presumably prove to be infrequent.

No reasonably current general taxonomic revision of the Gondwana Permian miospores exists, other than that attempted here. The only earlier attempts have been those of Hart (1964a) - the striate disaccates; and Hart (1965b) - the miospores as a whole. Only a few authors have since partly adhered to his conclusions; whilst approximately half of all the named miospores have appeared in subsequent literature.

After a comprehensive assessment of all the photographed specimens in the Gondwana Permian literature, the large majority were taken to fall within or very close to one or other of the 133 species defined from the Karoo Permian. The remainder are considered here to constitute an additional 70 species (listed in Tables 8 - 12, Chapter 5) which are mostly rare and of limited geographic and stratigraphic occurrence. Some of these are included in Karoo Permian genera, whilst the remainder fall within 17 additional genera. A total of 50 genera and 203 species is thus recognized as having been recorded to date from the Gondwana Permian.

Table 22 records, for the various plant groups or major genera, the degree of reduction in genera and species necessitated according to the present review. The figures in the 'literature' column include names originally applied to Northern Hemisphere Permian forms, to Northern Hemisphere and Gondwana forms from systems other than the Permian, and to forms which have been described as new from the Gondwana Permian. Figures applicable to the latter group are noted (in addition) in brackets. The figures in brackets in the 'revision' column represent the number of genera or species described from the Karoo Permian, whilst those not bracketed represent the total number of Gondwana genera or species. The figures in the 'literature' column do not include:

(a) Material described in unpublished works.

(b) Genera and species (as interpreted here) which appear for the first time in uppermost Permian strata (i.e. lowermost Narrabeen Group and Rewan Formation in Australia, Panchet Formation in India, and the uppermost 4 m of the Chhidru Formation in the Salt Range). In these strata appear many forms which are more Triassic in aspect than Permian (see Charts 6, 7 and 8 in Anderson & Anderson, 1970) and are not considered here when discussing diversity within the Permian.

(c) Genera and species purely listed or described without accompanying photographs.

To summarize, we thus get 283 genera and 749 species described in the literature, but only 50 genera and 203 species recognized in the present review.

Microfloral studies remain to be initiated in a good many Permian strata in various regions of Gondwanaland (see key page at start of appendix 9.3). Intensive studies with respect to miospore 'populations' remain to be done throughout. Sufficient material has however been published for the impression to be gained that a high proportion of the species, particularly the more common forms, have been encountered.

In attempting any estimate therefore of the number of species that may eventually come to light from the Gondwana Permian, it is the rare undiscovered forms that must be accounted for. It might be noted that whilst 30 of the northern Karoo species have not yet been recorded elsewhere, only 70 species from elsewhere in the Gondwana Permian have not yet been recorded from the Karoo. The relative paucity of the latter figure presumably reflects a lack of data. A tentative estimate of the total number of preserved Gondwana Permian miospores might be in the order of 60 genera and 250 species.

An argument against this low diversity is that it is apparent rather than real; that many of the fossil miospore species (by virtue of the limited morphological features available for study) may in fact represent a number of species or even higher taxa. It is well documented that such difficulties arise in certain groups of extant miospores. The degree to which similar problems affect the study of Permian miospores cannot be assessed at the present time. It might be hoped however, that with more comprehensive data both on microfloral and macrofloral 'populations', the answers to these questions will become more clear.

The remarkably restricted diversity of preserved Gondwana Permian miospores suggested in the present investigation is favoured in view of a number of independent lines of supportive evidence. The corroborative arguments are simply

TABLE 22 - Summary of number of taxa introduced in the literature compared to that recognized after review

	Gondwana Permian literature (excluding this paper)		Revision accord. to this paper (including this paper)	
Genera or supra-generic taxa	No. of genera	No. of species	No. of genera	No. of species
Acritarcha	23 (8 new),	31 (27 new)	13 (7 Karoo),	36 (18 Karoo)
Lycophyta	28 (8 new),	53 (45 new)	2 (2 Karoo),	15 (12 Karoo)
Microbaculispora	24 (7 new),	47 (38 new)	1 (1 Karoo),	38 (27 Karoo)
Other spores	60 (19 new),	154 (122 new)	22 (16 Karoo),	54 (34 Karoo)
Vestigisporites	48 (26 new),	153 (139 new)	1 (1 Karoo),	14 (9 Karoo)
Vittatina Pityosporites Lueckisporites	76 (32 new),	289 (257 new)	3 (3 Karoo),	35 (28 Karoo)
Other grains	14 (5 new),	22 (21 new)	8 (3 Karoo),	11 (5 Karoo)
TOTAL:	283 (105 new),	749 (649 new)	50 (33 Karoo),	203 (133 Karoo)

noted without elaboration since a comprehensive appraisal of them would justify a manuscript in its own right. Much of the data can be found in Anderson & Anderson, 1970; Anderson, 1973; 1976 (in press).

(a) Gondwanaland is visualized as a united supercontinent throughout the Permian with few major natural barriers inhibiting migrations of species.

(b) A particularly large proportion of this supercontinent comprised low lying depositional areas conducive to the widespread development of similar biological communities.

(c) The climatic regime throughout Gondwanaland appears to have been remarkably uniform at any one time.

(d) The macroflora shows every evidence of being of very restricted diversity and of a remarkably uniform nature throughout the depositional areas. It is generally agreed that Gondwanaland formed a single plant kingdom.

(e) The angiosperms which today dominate amongst the vascular plants, and which appear to show a highly developed potential for diversification, had not yet appeared on the scene.

(f) The tetrapod vertebrates appear to have migrated southwards into Gondwanaland from the then tropical regions of Euramerica only in the Middle Permian. Through the remainder of the Permian they are in evidence only in the southern African region. However, by the close of the period (i.e. at the time of the deposition of the Lystrosaurus Zone and its equivalents) they appear to have colonized most of Gondwanaland. At this time the faunal assemblage as found in the widely separated regions of South Africa, India and Antarctica was extremely uniform and limited in diversity.

Summary of results

(a) A total of 33 genera and 133 species of miospores is recorded from the northern Karoo Permian. This is regarded as being a reasonably comprehensive tally of the miospores preserved in these deposits.

(b) An assessment of all illustrated Gondwana Permian miospores (inclusive of the present work) has led to the conclusion that only 50 genera and 203 species have been recovered to date. It is estimated that the total number of preserved Gondwana Permian miospores might be in the order of 60 genera and 250 species. Although certain of these forms may not represent natural taxa, but include a number of related or even unrelated species or genera, it is concluded that floral diversity during Permian times was considerably lower than today.

(c) A zonation scheme for the northern Karoo Permian incorporating 21 microfloral stages is recognized. In view of the scarcity of other fossil groups, the microfloras are of prime value in correlation. The correlations that can be effected on the presently available data are indicated on Charts 1 and 2.

(d) A more tentative zonation scheme for the Dwyka Tillites and Upper Dwyka Shales of the southern Karoo has been compiled, eight 'microfloral stages' having been recognized. The miospore suites of these stages cannot be closely matched with those of any of the northern Karoo stages. However, sufficient similarities exist for the correlations indicated on Chart 1 to be suggested. The lowest portion of the southern Dwyka Tillite is possibly of Carboniferous age, whilst the remainder of the Tillites are possibly younger than the northern Karoo Tillites. The Upper Dwyka Shales apparently span the upper half of the Lower Ecca and the lower half of the Middle Ecca of the northern Karoo.

(e) The diversity of flora colonizing the northern Karoo appears to have varied quite markedly and progressively through the Permian, the number of recorded species increasing from 31 in the Dwyka Tillite to a maximum of 105 in the Middle Ecca and thereafter decreasing again to 18 in the Daptocephalus Zone. A period of very successful speciation (possibly migration from elsewhere) apparently occurred after the withdrawal of the glaciers and continued throughout the duration of Lower and Middle Ecca accumulation. With the onset of the post Middle Ecca transgression a long period of decline set in, during which many species disappeared from the region whilst only a few new forms appeared. Whereas the Middle Ecca regression witnessed a remarkable flowering in speciation, a similarly remarkably reduction in diversity characterises the Tapinocephalus Zone regression.

(f) The GSAD patterns of the miospores depicted on the 'species pages' graphically illustrate a number of interesting phenomena with respect on Gondwana Permian microfloras.

Of the 203 recorded species a high proportion display very wide geographic and stratigraphic distribution. Some 25 species are found to occur throughout Gondwanaland, whilst many others colonized considerable areas of it. About half of the species exhibit a stratigraphic range extending through more than half of the 45 million year duration of the Permian.

In many species the SAD patterns displayed in different depositional basins are at considerable variance, whilst in some species it is possible to discern the region of first appearance in Gondwanaland and the direction and rate of colonization, or the trends of diachronous extinction region to region. In view of these variable distribution patterns, due care must be exercixed in attempting inter-regional correlations.

Once a stable scheme of taxonomy has been achieved and a good proportion of the preserved suitable Permian strata of both hemispheres have been subjected to intensive microfloral study, the interpretation of the global patterns of Permian floral distributions will be considerably enhanced.

CHAPTER 8

General

8.1 GLOSSARY

8.1.1 Abbreviations

BPI: Bernard Price Institute for Palaeontological Research. (Witwatersrand University).

ICBN: International Code of Botanical Nomenclature (as adopted at Seattle, 1969).

SACS: South African Committee for Stratigraphy.

SAD: Stratigraphic/ abundance/ distribution; refers to the known stratigraphic extent and varying relative abundance through time of a particular species in a particular defined relatively restricted geographic region (e.g. northern Karoo Basin).

GSAD: Geographic/ stratigraphic/ abundance/ distribution; refers to the known stratigraphic and geographic extent and varying relative abundance through time and space of a particular species in a particular defined relatively broad geographic region (e.g. Gondwanaland).

SAMC: Single assemblage morphological continuum; a series of two or more species from a single assemblage which overlap morphologically or which form part of a compound population.

MAMC: Multiple assemblage morphological continuum; a series of two or more species and/or SAMCs from two or more assemblages whose available populations overlap morphologically.

8.1.2 Coded reference to assemblages and sub-assemblages

HKr, GrR, Kb etc.: Simple letter codes with no appended depths refer to assemblages derived from surface localities.

SAP 6 1007'6", LA 5349, UC 678 151,0 etc.: Refer to assemblages derived from borehole localities. In the case of metrically logged boreholes the metre sign is omitted.

P13 147,70/146,80, SAP 6 1152'9"/1151'3" etc.: Assemblages for which 2 or more sub-assemblages have been studied are coded in this manner. The two depths indicated refer to the oldest and youngest sub-assemblages respectively.

8.1.3 Species numbers and geographic area numbers

Species numbers

The 133 species described from the northern Karoo Permian have been arranged in Appendix 9.3 ('Species pages') as far as possible in natural order. The 'Species pages' (each page pertaining to a particular species) are numbered 1 to 133. Wherever a species is listed in a chart or table or mentioned in the text the relevant 'Species page' number is noted alongside.

Geographic area numbers

In Chart 1, the generalized stratigraphic sequence encountered at each of 36 areas within the Karoo Basin is indicated and these are correlated one against the other. The areas are numbered 1 to 36 in a clockwise manner around the Karoo Basin (starting in the S.E.). Wherever an area is referred to elsewhere in this work, the relevant number is appended, e.g. Standerton (24).

8.1.4 Definition of general terms

The following terms and phrases are employed regularly in the present work and require definition. Some are introduced here for lack of available terminology, whilst the remainder are used in a particular sense where a variety of connotations could be implied.

Miospores: The following microscopic plant organs fall within the category miospore: spores (of homosporous plants), microspores (as opposed to megaspores in heterosporous plants), pollen grains, unicellular algae.

Microflora: That suite of miospore species occurring in a particular region during a particular narrow interval of time.

Populations and species: See 3.2.

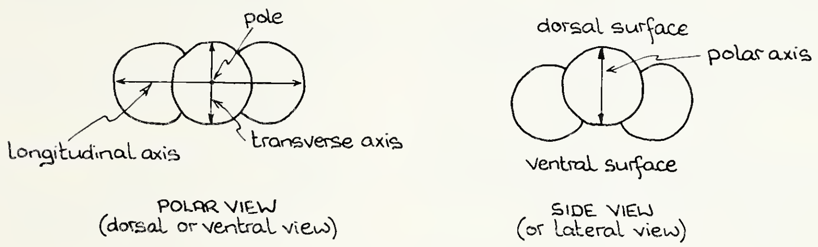
Distinct species: A species whose available reference or representative populations do not overlap morphologically with those of any other species, nor do they comprise part of a compound population.

Reference population: The most adequate available photographically illustrated population proposed as reference for a particular species.

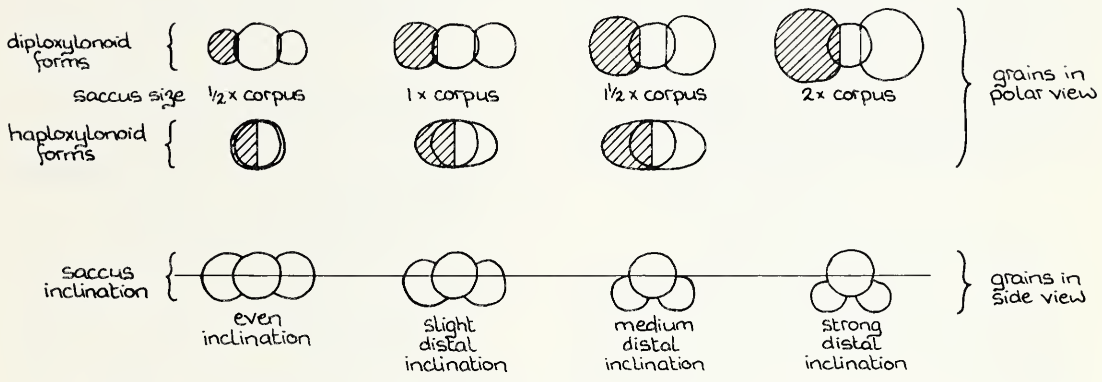
FIG. 10

Schematic illustration of selected miospore features

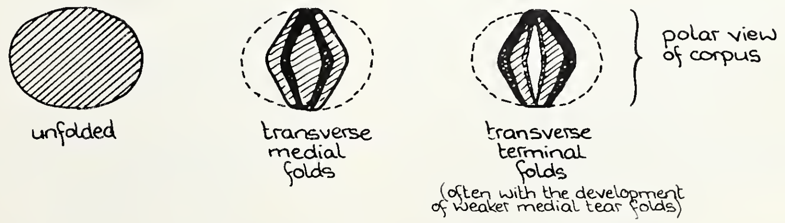
a) Aspect and axes in miospores



b) Sacci (xylonity, size, inclination)



c) Corpus preservation


unfolded
transverse medial folds
transverse terminal folds
(often with the development of weaker medial tear folds)
polar view of corpus

Representative population: Any available photographically illustrated population, other than a reference population, representing a particular species.

Simple population: A population which falls entirely within the defined limits of a particular species.

Compound population: A population whose morphological limits overlap the defined limits of two or more particular species.

Split population: The portion of a compound population which falls within the defined limits of a particular species.

Reference specimen: That specimen nominated as representing the norm of a reference population. It has only been introduced in cases where the reference population does not include the type specimen.

Hypodigm: The hypodigm of a particular species includes all the photographically illustrated Gondwana Permian specimens considered here to fall within the species.

Locality: A distinct site of narrowly confined areal extent, but with no restriction as to stratigraphic extent, from which one or more samples have been collected. Thus a borehole, a shaft, a surface exposure, etc. all fall within the definition of a locality.

Sample: A single rock specimen processed for examination of its miospore content.

Assemblage: The full suite of miospore populations isolated from 1 or more samples from a distinct lithological unit of narrowly confined geographic and stratigraphic extent (lithosome).

Sub-assemblage: The full suite of miospore populations isolated from a defined part of a distinct lithological unit of narrowly confined geographic and stratigraphic extent (lithosome). The term is applied only where two or more sub-assemblages have been selected for study.

8.1.5 Miospore descriptive terminology

Most of the morphological terms employed in the systematic descriptions are used as defined in the 'Morphologic Encyclopedia of Palynology' prepared by Kremp (1965). Only those terms which are ambiguous, used in a different sense, or do not appear in Kremp (1965) are explained or illustrated (Fig. 10).

Exoexine and intexine: In all cases where the exine (wall) of a miospore is separated into two layers, the inner layer is referred to as the intexine and the outer layer as the exoexine.

Striae and ribs: In the striate pollen grains the two elements of the ornamentation are referred to as striae and ribs, the striae being the narrow elongate grooves and the ribs the broader elongate raised portions running between them. In the genus *Lueckisporites* where the striae are more pronounced they are referred to as clefts.

Size: The size measurements given refer to the greatest diameter of the undamaged miospore inclusive of ornamentation or sacci.

8.2 NEW COMBINATIONS

The following is a list of new combinations, used in this memoir, citing basionyms with authors and original publications.

Apiculatisporis bulliensis *(Henn.) J.M. Anderson*, comb. nov.
Apiculatisporites bulliensis Henn. in Proc. Linn. Soc. N.S.W. 83,3: 364 (1958)

Apiculatisporis diversiformis *(Balme & Henn.) J.M. Anderson*, comb. nov.
Calamospora diversiformis Balme & Henn. in Aust. J. Bot. 4,3: 246 (1956)

Apiculatisporis scotinus *(Segr.) J.M. Anderson*, comb. nov.
Lophotriletes scotinus Segr. in Grana palynol. 10,1: 55 (1970)

Circulisporites calvitium *(Balme & Segr.) J.M. Anderson*, comb. nov.
Peltacystia calvitium Balme & Segr. in J. Proc. R. Soc. West. Aust. 49,1: 30 (1966)

Circulisporites monile *(Balme & Segr.) J.M. Anderson*, comb. nov.
Peltacystia monile Balme & Segr. in J. Proc. R. Soc. West. Aust. 49,1: 28 (1966)

Circulisporites venosus *(Balme & Segr.) J.M. Anderson*, comb. nov.
Peltacystia venosa Balme & Segr. in J. Proc. R. Soc. West. Aust. 49,1: 27 (1966)

Cyclogranisporites bhardwaji *(Hart) J.M. Anderson*, comb. nov.
Baculatisporites bhardwaji Hart in Bull. geol. Surv. Tanganyika 36: 11 (1963)

Cyclogranisporites indicus *(Bharad. & Sal.) J.M. Anderson*, comb. nov.
Cyclobaculosporites indicus Bharad. & Sal. in Palaeobotanist 12,2: 194 (1964)

Cyclogranisporites parvus *(Lak., Sah & Dube) J.M. Anderson*, comb. nov.
Planisporites parvus Lak., Sah & Dube in Palaeobotanist 7,2: 112 (1960)

Cyclogranisporites planiverrucatus *(Imgrund) J.M. Anderson*, comb. nov.
Verrucosisporites planiverrucatus Imgrund in Geol. Jahrb. 77: 163 (1960)

Cyclogranisporites poniatiensis *(Bharad.) J.M. Anderson*, comb. nov.
Eupunctisporites poniatiensis Bharad. in Palaeobotanist 9,1 & 2: 79 (1962)

Gondisporites braziliensis *(Pant & Sriv.) J.M. Anderson*, comb. nov.
Densosporites braziliensis Pant & Sriv. in Micropaleontology 11,4: 469 (1965)

Gondisporites complicatus *(Balme) J.M. Anderson*, comb. nov.
Densoisporites complicatus Balme in Univ. Kans. Dept. Geol. Sp. Publ. 4: 341 (1970)

Gondisporites congoensis *(Mahesh. & Bose) J.M. Anderson*, comb. nov.
Densosporites congoensis Mahesh. & Bose in Annls. Mus.r. Afr. cent., Sci. geol. 63: 27 (1969)

Gondisporites lacunatus *(Tiw.) J.M. Anderson*, comb. nov.
Dentatispora lacunata Tiw. in Palaeobotanist 13,2: 178 (1965)

Gondisporites punctatus *(Hart) J.M. Anderson,* comb. nov.
Grandispora punctata Hart in S.Afr. J. Sci. 59,5: 140 (1963)

Gondisporites rotundidentatus *(Segr.) J.M. Anderson,* comb. nov.
Densosporites rotundidentatus Segr. in Grana palynol. 10,1: 62 (1970)

Gondisporites splendens *(Balme & Henn.) J.M. Anderson,* comb. nov.
Cirratriradites splendens Balme & Henn. in Aust. J. Bot. 4,3: 252 (1956)

Laevigatosporites striatus *(Sal.) J.M. Anderson,* comb. nov.
Latosporites striatus Sal. in Palaeobotanist 13,3: 230 (1965)

Lueckisporites alatus *(Venk. & Kar) J.M. Anderson,* comb. nov.
Corisaccites alatus Venk. & Kar in Palaeobotanist 15,1 & 2: 108 (1966)

Lueckisporites asulcus *(Bose & Kar) J.M. Anderson,* comb. nov.
Strotersporites asulcus Bose & Kar in Annls. Mus.r. Afr. cent. Sci. geol. 53: 105 (1966)

Lueckisporites hannonicus *(Goub.) J.M. Anderson,* comb. nov.
Guttulapollenites hannonicus Goub. in Revue Inst. fr. Pétrole 20,10: 1431 (1965)

Lueckisporites vanus *(Venk. & Kar) J.M. Anderson,* comb. nov.
Corisaccites vanus Venk. & Kar in Palaeobotanist 15,1 & 2: 108 (1966)

Maculatasporites eraduensis *(Segr.) J.M. Anderson,* comb. nov.
Spongocystia eraduica Segr. in Micropaleontology 13,3: 297 (1967)

Mehlisphaeridium gondwanensis *(Tiw.) J.M. Anderson,* comb. nov.
Maculatasporites gondwanensis Tiw. in Palaeobotanist 13,2: 205 (1965)

Microbaculispora biornata *(Balme & Henn.) J.M. Anderson,* comb. nov.
Camptotriletes biornatus Balme & Henn. in Aust. J. Bot. 4,3: 252 (1956)

Microbaculispora dentata *(Balme & Henn.) J.M. Anderson,* comb. nov.
Acanthotriletes dentatus Balme & Henn. in Aust. J. Bot. 4,3: 248 (1956)

Microbaculispora directa *(Balme & Henn.) J.M. Anderson,* comb. nov.
Leiotriletes directus Balme & Henn. in Aust. J. Bot. 4,3: 244 (1956)

Microbaculispora ericiana *(Balme & Henn.) J.M. Anderson,* comb. nov.
Acanthotriletes ericianus Balme & Henn. in Aust. J. Bot. 4,3: 248 (1956)

Microbaculispora micronodosa *(Balme & Henn.) J.M. Anderson,* comb. nov.
Granulatisporites micronodosus Balme & Henn. in Aust. J. Bot. 4,3: 245 (1956)

Microbaculispora naumovae *(Hart) J.M. Anderson,* comb. nov.
Verrucosisporites naumovai Hart in S.Afr. J. Sci. 59,5: 143 (1963)

Microbaculispora plicata *(Mahesh. & Bose) J.M. Anderson,* comb. nov.
Leiotriletes plicatus Mahesh. & Bose in Annls. Mus.r. Afr. cent., Sci. geol. 63: 11 (1969)

Microbaculispora plumsteadiae *(Hart) J.M. Anderson,* comb. nov.
Reinchospora plumsteadiae Hart in S.Afr. J. Sci. 59,5: 142 (1963)

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Cirrabaculisporites praeclarus Mahesh. & Bose in Annls. Mus. r. Afr. cent., Sci. geol. 63: 22 (1969)

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Microbaculispora quadruplex *(Segr.) J.M. Anderson,* comb. nov.
Granulatisporites quadruplex Segr. in Grana palynol. 10,1: 50 (1970)

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Pilasporites scissus *(Balme & Henn.) J.M. Anderson,* comb. nov.
Laevigatosporites scissus Balme & Henn. in Aust. J. Bot. 4,1: 56 (1956)

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Pityosporites levis *(Tiw.) J.M. Anderson*, comb. nov.
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Pityosporites maximus *(Hart) J.M. Anderson*, comb. nov.
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Calamospora exila Bharad. & Sal. in Palaeobotanist 12,2: 191 (1964)

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Tetraporina punctata *(Tiw. & Nav.) J.M. Anderson*, comb. nov.
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Balmeella tetragona Pant & Mehra in Grana palynol. 4,1: 116 (1963)

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Vestigisporites gracilis *(Segr.) J.M. Anderson*, comb. nov.
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Valiasaccites validus Bose & Kar in Annls. Mus.r. Afr. cent., Sci. geol. 53: 45 (1966)

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Marsupipollenites fasciolatus Balme & Henn. Aust. J. Bot. 4,1: 62 (1956)

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8.3 METRICATION OF BOREHOLE DEPTHS

Throughout the text and appendices borehole depths follow the system of measurement (British or metric) used in original logging. All 53 northern Karoo and 42 southern Karoo assemblages selected for study are listed (in Table 23) in their original form. Alongside all British measurements are given the metric equivalents. Sub-assemblages are bracketed.

TABLE 23 - List of miospore assemblage codes with British measurements converted to metric

Northern Karoo		Southern Karoo	
Assemblage code	Metric equivalent	Assemblage code	Metric equivalent
LKf		VR 10503'	3201,31
Kb		VR 10764'	3280,87
GrR		AB 6246'	1903,78
OW 94'	28,65	AB 6294'	1918,41
OW 159'	48,46	AB 6346'	1934,26
OW 170'	51,12	AB 6357'	1937,61
OW 312'	95,10	AB 6401'	1951,02
OW 337'	102,72	AB 6429'	1959,56
SAP 7 278'	84,73	AB 6457'	1968,09
SAP 7 287'	87,48	AB 6644'	2025,09
SAP 7 310'	94,49	Ab 6699'	2041,86
SAP 7 338'	103,02	AB 6860'	2090,93
SAP 7 464'	141,43	AB 6944'	2116,53
SAP 6 521'	158,80	AB 7051'	2149,14
SAP 7 570'	173,74	AB 7067'	2154,02
SAP 6 688'	209,70	AB 7083'	2158,90
SAP 7 712'	217,02	QU 7306'	2226,87
SAP 6 825'	251,46	QU 7336'	2236,01
SAP 7 760'	231,65	QU 7367'	2245,46
SAP 6 876'	267,00	QU 7689'	2343,61
SAP 7 813'	247,80	SA 9538'	2907,18
SAP 6 927'	282,55	SA 9542,4'	2908,52
SAP 6 944'	287,73	SA 9555'	2912,37
SAP 6 991'	302,06	SA 9600'	2926,08
UC 678 30,6		SA 10200'	3108,96
UC 678 31,6		SA 11220'	3419,86
SAP 6 1000'	304,80	SA 11400'	3474,72
SAP 6 1007'	306,93	OL 1146'	349,30
SAP 6 1007' 6"	307,09	OL 1179'	359,36
SAP 6 1017'	309,98	OL 1185'	361,19
SAP 6 1019'	310,59	OL 1231'	375,21
UC 621 153'	46,63	OL 1236'	376,73
UC 678 78,9		OL 2130'	649,22
UC 678 79,0		OL 2188'	666,90
UC 678 79,3		OL 2350'	716,28
UC 678 80,6		KL 1285'	391,67
OW 1145'	349,00	KL 1355'	413,00
OW 1148'	349,91	KL 1457'	444,09
OW 1156'	352,35	KL 1670'	509,02
HKr		KL 1875'	571,50
G 172 117'	35,66	KL 2060'	627,89
OW 1171'	356,92	KL 2299'	700,74
P 13 126,50			
P 13 128,13			
UC 678 108,6			
WV 3 133,50			
A 401 10,05			
A 401 30,85			
A 401 40,30			
OW 1257'	383,13		
UC 678 151,00			
P 13 140,6			
P 13 146,8			
P 13 147,7			
LA 5349'	1630,38		
LA 5379'	1639,52		
LA 5395'	1644,40		
LA 5419'	1651,71		
SAP 6 1130'	344,42		
SAP 6 1131'	344,73		
SAP 6 1133'	345,34		
P 13 152,95			
P 13 153,39			
P 13 154,35			
SAP 6 1151' 3"	350,90		
SAP 6 1152' 3"	351,21		
SAP 6 1152' 9"	351,36		
UC 608 1262'	384,66		
UC 729 504,0			
UC 729 550,0			
UC 729 555,0			
UC 729 556,0			
UC 608 1590'	500,60		

8.4 REFERENCES

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9.1 CHARTS 1,2,3,4; Map 1

CHART 1 CORRELATION of PERMIAN STRATA of KAROO BASIN

General Notes

For additional explanation of chart see Chapter 2.1

An attempt is made to include comprehensive coverage of the different areas and facies within the Karoo Basin

For location of boreholes (eg. SP 1/69), surface sections (eg. Grahamstown - Queenstown), and general areas (eg. Douglas/Kimberley/Boshof) see map 1

Columns 1-35 are arranged such as to present a roughly clockwise section (starting at East London in the S.E.) through the Karoo Basin

Column 36 represents a small detached basin just to the north of the Karoo Basin

Note the symbols used to indicate the different fossil groups.

The majority of the known palaeontologically productive horizons in the Permian of the Karoo Basin are accounted for in this chart. The following groups of plant or animal remains are rare and/or poorly known and are therefore not included - (a) silicified wood and other wood impressions and compressions not found in normal leaf bearing strata; (b) fish; (c) tetrapod vertebrate tracks; (d) freshwater molluscs, (e) small crustaceans (e.g. Conchostraca, Ostracoda); (f) worm burrows.

Biozones and Fossiliferous Strata

Microflora For explanation of zonation scheme see Chapter 6. All, and only those, sections found to be productive and studied in the present work are indicated (note symbols) in columns 1-36. Other sections with the appropriate lithology, and where unmetamorphosed, will be productive, but these are not marked.

Macroflora. Only those horizons in which good leaf-bearing localities are known to occur are taken account of in the biozonation scheme and are indicated in columns 1-36.

Tetrapod vertebrates. In columns 1-36, the productive horizons are noted not only where they are known in outcrop but also in those strata intersected by boreholes where they are expected to occur.

Marine invertebrates are known from only 3 localities to date (see map 1). These are all thought to occur within a single marine horizon which occurs throughout at least the southern ²/₃ of the Karoo Basin.

Non-marine invertebrates. The insect fauna of the Daptocephalus Zone (Estcourt-Mpendhle area) and the crustacean fauna (notocarids) of the White Band (N.W. and W. outcrop belt) are included as biozones, but are not marked in columns 1-36.

Arthropod trails. . Approximate biozones are given separately for the southern, central and northern Karoo regions. No attempt is made to indicate the productive horizons in the 36 stratigraphic columns.

		References
1.	Blignaut & Furter '40	Vryheid
2.	Blignaut & Furter '52	Charlestown/Newcastle; Wakkerstroom/Utrecht
3.	Sehlke & van der Merwe '59	Standerton (13 holes)
4.	Buchmann '60	Trompsburg
5.	Johnson '66	Grahamstown - Queenstown; S.E. Karoo lithostrat. nomencl.
6.	Marshall '66	SO
7.	Geol Survey ('S. Africa) '53-'67	Dannhauser
8.	Ryan '67	Karoo Basin (Ecca and L. Beauf.); Karoo lithostrat. nomencl.
9.	Stratten '68	Karoo Basin (Dwyka); Karoo basement
10.	Hill '69	MA
11.	Haughton '69	Springhok Flats; Karoo lithostrat. nomencl.
12.	Rowsell '69	Natal (Beaufort); Durban (M. Ecca)
13.	Rust '69	Biostrat. age of T.M.S.
14.	Venter '69	SP, WE, CR, SC, VR, KA, AB, QU, KW, SA, KL
15.	Anderson, H. & Anderson, J. '70	Strata overlying Lystrosaurus Zone
16.	South Africa (geol. map) '70	Systems underlying Karoo; S. Karoo lithostrat. nomencl.
17.	Proedrou '71	KC, AM, KD, DU
18.	Kitching '72	Beaufort vertebrate zonation
19.	Roux '72	ME
20.	Theron '72	Biostrat. age of Bokkeveld and Witteberg Series
21.	Van Vuuren '72	MA, SW
22.	Winter & Venter '72	SP, WE, CR, SC, VR, KA, AB, QU, KW, SA, KL, OL, GL, CL, BE
23.	Anderson, J. '73	Reference Stages and Sub-stages; absolute ages; correlations
24.	Bars '73	Oliviershoek Pass, Memel
25.	Joubert '73	Kimberley/Boshoff
26.	Loock '73	Unconformity between Witteberg Series and Dwyka
27.	McLachlan & Anderson, A. '73	Dwyka marine horizon; Douglas; White Band faunas
28.	Pyke '73	W1
29.	Anderson, A. '74	Arthropod trails
30.	S. Afr. Comm. for Strat. '74	Lithostrat. nomencl.
31.	McLachlan & Anderson, A. '75	Dwyka marine horizon
32.	Author	Microflora, macroflora, insect fauna, LA, Welkom/Virginia; Sasolburg; Greylingstad/Bethal/Hendrina; Standerton (1 borehole); correlations

Thickness Data

(all thicknesses given in meters)

·300	Borehole or surface section
R300	Reference section
±300	Average over specified area
50-300	Range over specified area
300+	Greater than
?300	Authors estimate from available data
??300	No estimate possible from available data.
	Total thickness divided evenly between units marked ??
$\widetilde{300}$	Upper portions eroded away
$\underset{\sim}{300}$	Lower portions not exposed (or drilled)
?	Undrilled, unexposed
??	Information not available in references cited
	Rock unit absent

The thicknesses given for the Upper Dwyka Shales (columns 1-17) are inclusive of the White Band. Insufficient data is available to enable giving thicknesses for the White Band for each borehole. It seems unlikely, however, that it ever exceeds 50 m.

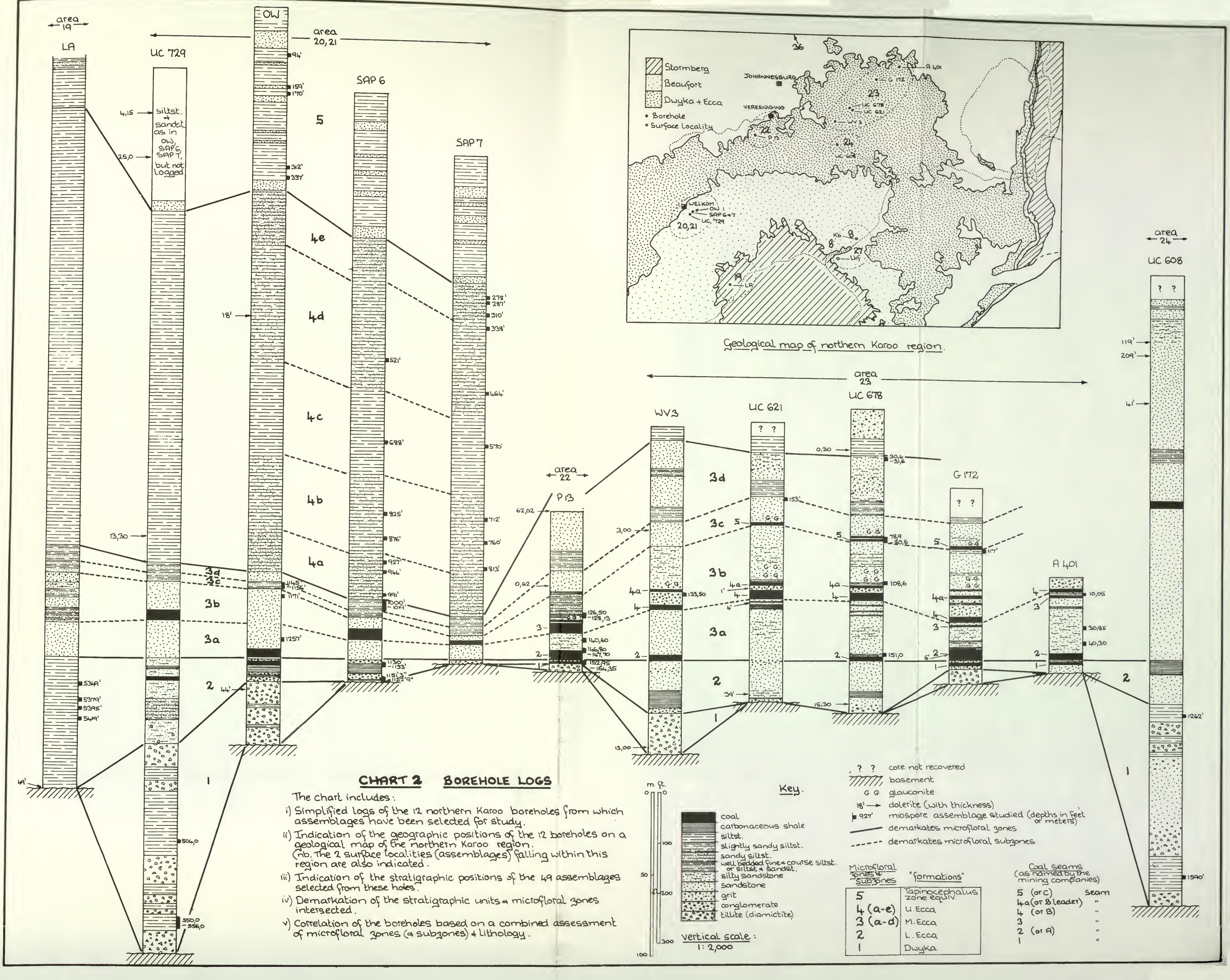
The 'transition beds' between the L. Ecca (shales) & Dwyka tillites (see columns 18-35) are not given an independent thickness value. In the Welkom area they are included in the 30+ metres of the L. Ecca. It is not clear from the literature consulted for the remaining areas whether the strata here freferred to as the 'transition beds' were included as part of the L. Ecca or the Dwyka Tillite.

The beds of the Lystrosaurus Zone are overlain with approximate paraconformity by strata of either the Cynognathus Zone (± Mid Scythian), Molteno fm. (± L. Carnian), or Red Beds (± Rhaetian).

The sediments of the Karoo Basin overly, with varying type & degree of unconformity (i.e. paraconformity, disconformity, angular unconformity & nonconformity), rocks of a considerable range of ages, i.e. Swaziland System (oldest) to Witteberg Series (youngest). See table to right. Along the whole of the southern outcrop belt of the Karoo Basin, the Dwyka tillites rest with approximate paraconformity on the upper shales (± L. Caboniferous, Visean, ± 350 m.y.) of the Witteberg Series. Here occurs the shortest time break between basement & Karoo strata, i.e. on present evidence ± 55 m.y.

Overlying and Underlying Strata

Geological System		Approximate age (m.y.)
Cape	Witteberg Series	370 - 350 (U. Dev. - L. Carb.)
	Bokkeveld Series	400 - 370 (L. Dev.)
	T.M.S.-Table Mountain Series	500 - 400 (L. Ord. - U. Sil.)
Nama		600
Granite (2)		1100
Waterberg		1600
B.I.C. - Bushveld Igneous Complex		1950
Transvaal		2100
Ventersdorp		2300
Witwatersrand		2500
Pongola		3000
Granite (1)		3100
Swaziland		>3300



Geological map of northern Karoo region.

CHART 2 BOREHOLE LOGS

The chart includes:

i) Simplified logs of the 12 northern Karoo boreholes from which assemblages have been selected for study.

ii) Indication of the geographic positions of the 12 boreholes on a geological map of the northern Karoo region. (nb. The 2 surface localities (assemblages) falling within this region are also indicated.

iii) Indication of the stratigraphic positions of the 49 assemblages selected from these holes.

iv) Demarkation of the stratigraphic units + microfloral zones intersected.

v) Correlation of the boreholes based on a combined assessment of microfloral zones (+ subzones) + lithology.

Key.

- coal
- carbonaceous shale
- siltst.
- slightly sandy siltst.
- sandy siltst.
- well bedded fine + course siltst. or siltst + sandst.
- silty sandstone
- sandstone
- grit
- conglomerate
- tillite (diamictite)

Vertical scale: 1: 2,000

? ? core not recovered
basement
G G glauconite
18' → dolerite (with thickness)
927' miospore assemblage studied (depths in feet or meters)
—— demarkates microfloral zones
------ demarkates microfloral subzones

Microfloral zones + subzones	"formations"
5	Tapinocephalus zone equiv.
4 (a-e)	U. Ecca
3 (a-d)	M. Ecca
2	L. Ecca
1	Dwyka

Coal seams (as named by the mining companies)

5 (or C) seam
4a (or B leader) "
4 (or B) "
3 "
2 (or A) "
1 "

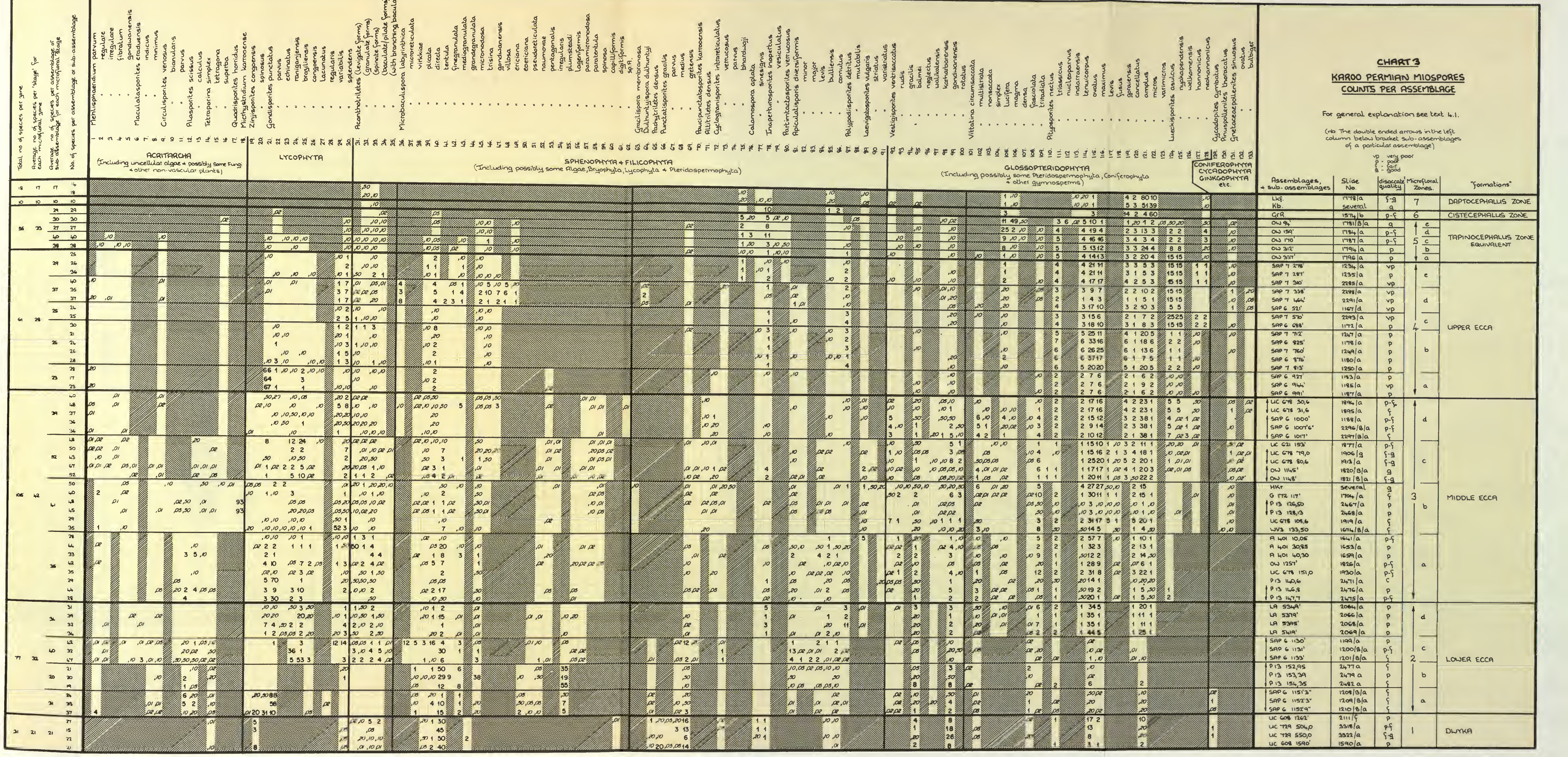


CHART 3

KAROO PERMIAN MIOSPORES COUNTS PER ASSEMBLAGE

For general explanation see text 4.1.

(nb The double ended arrows in the left column below bracket sub-assemblages of a particular assemblage)

vp very poor
p - poor
f - fair
g - good

ACRITARCHA
(Including unicellular algae + possibly some Fungi + other non-vascular plants)

1. Mehlisphaeridium parvum
2. " regulare
3. " irregulare
4. " fibratum
5. " gondwanensis
6. Maculatasporites eraduensis
7. " indicus
8. " minimus
9. Circulisporites venosus
10. " bianularis
11. " parvus
12. Plasporites scissus
13. " calculus
14. Tetraporina simplex
15. " tetragona
16. " superba
17. Quadrisporites horridus
18. Michrystridium karrooense

LYCOPHYTA

19. Zinjisporites congoensis
20. " spinosus
21. Gondisporites punctatus
22. " parvus
23. " echinatus
24. " raniganjensis
25. " braziliensis
26. " congoensis
27. " lacunatus
28. " regularis
29. " variabilis
30. " splendens

SPHENOPHYTA + FILICOPHYTA
(Including possibly some Algae, Bryophyta, Lycophyta + Pteridospermophyta)

31. Acanthotriletes (levigate forms)
32. " (granulate forms)
33. " (spinate forms)
34. " (baculate/pilate forms)
35. " (with branching baculae)
36. Microbaculispora labyrinthica
37. " microreticulata
38. " virkkiae
39. " plicata
40. " directa
41. " tentula
42. " finegranulata
43. " mediogranulata
44. " grandegranulata
45. " micronodosa
46. " trisina
47. " gondwanensis
48. " villosa
49. " ericiana
50. " eoericiana
51. " pseudoreticulata
52. " naumovae
53. " pentagonalis
54. " irregularis
55. " plumsteadi
56. " lageniformis
57. " paramicronodosa
58. " paratentula
59. " spinosa
60. " capilliformis
61. " digitiformis
62. " sp. A.
63. Gracilispora membranosa
64. Dulhuntyispora dulhuntyi
65. Pachytriletes densus
66. Punctatisporites gracilis
67. " parvus
68. " medius
69. " gretensis
70. Paucipunctatosporites karrooensis
71. Altitriletes densus
72. Cyclogranisporites intrareticulatus
73. " verrucosus
74. " parvus
75. " bharadwaji
76. Calamospora aplata
77. " sinesignis
78. Inaperturosporites inapertus
79. " vesiculatus
80. Partimtactosporites verrucosus
81. Apiculatisporis diversiformis
82. " minor
83. " major
84. " levis
85. " bulliensis
86. " cornutus
87. Polypodiisporites detritus
88. " mutabilis
89. Laevigatosporites vulgaris
90. " striatus
91. " varistriatus

GLOSSOPTERIDOPHYTA
(Including possibly some Pteridospermophyta, Coniferophyta + other gymnosperms)

92. Vestigisporites ventrisaccatus
93. " rudis
94. " gracilis
95. " balmei
96. " neglectus
97. " walikalensis
98. " karharbarensis
99. " gondwanensis
100. " rotatus
101. Vittatina circumsaccata
102. " multistriata
103. " nonsaccata
104. " simplex
105. " lucifera
106. " magna
107. " densa
108. " fasciolata
109. " triradiata
110. Pityosporites nectus
111. " triassicus
112. " nucleoparvus
113. " indarraensis
114. " tenuicorpus
115. " ovatus
116. " maximus
117. " levis
118. " fusus
119. " goraiensis
120. " cancellatus
121. " amplus
122. " micros
123. " varimicros
124. Lueckisporites asulcus
125. " nyakapendensis
126. " welkomensis
127. " hannonicus
128. " neohannonicus

CONIFEROPHYTA CYCADOPHYTA GINKGOPHYTA etc.

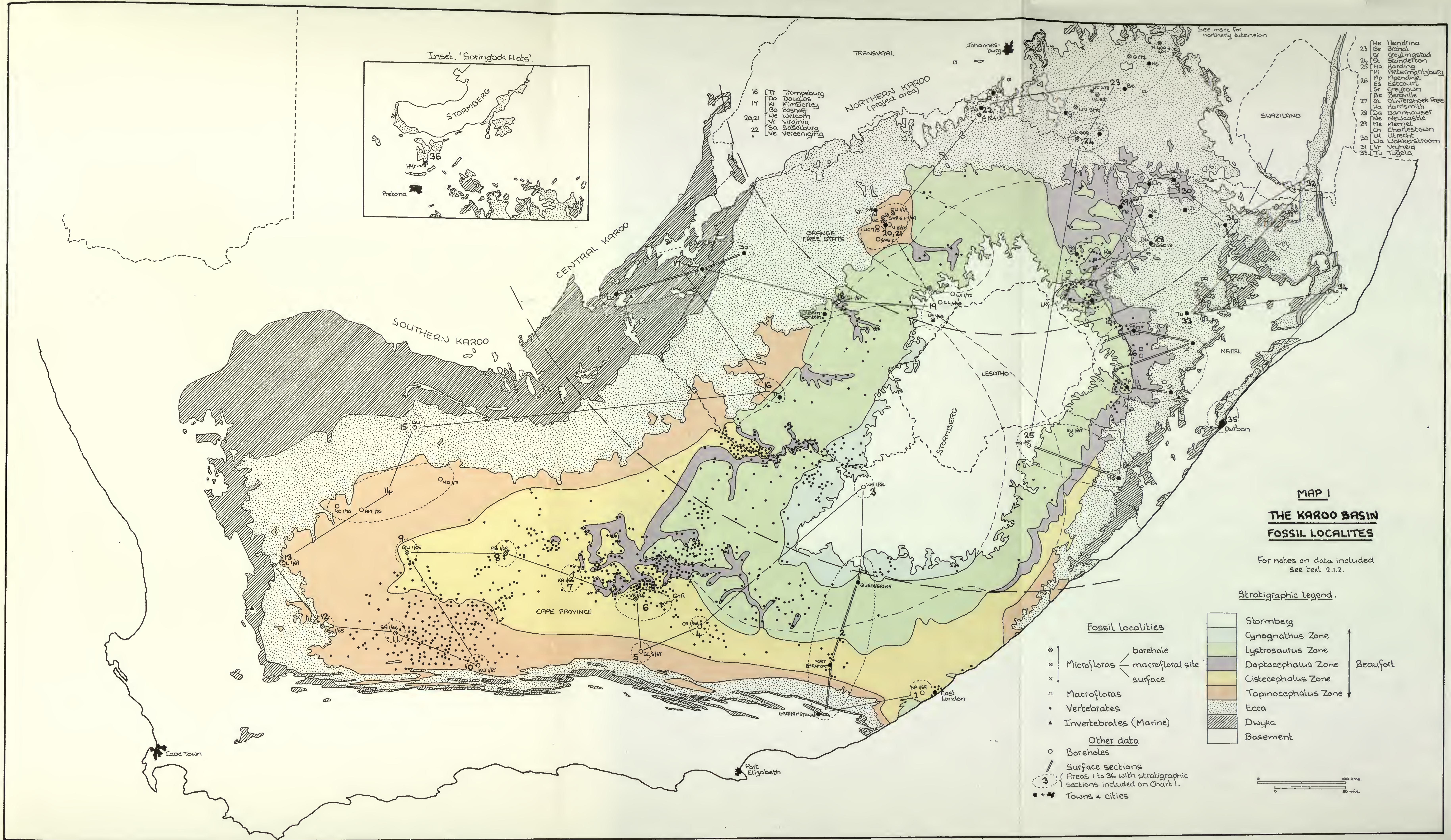
129. Cycadopites cymbatus
130. Pinuspollenites thoracatus
131. Gnetaceaepollenites sinuosus
132. " ovatus
133. " bulbiger

Total no of species per zone	Average no of species per 'stage' for each microfloral zone	Average no of species per assemblage of sub-assemblage for each microfloral stage	No. of species per assemblage or sub-assemblage	Assemblages, + sub-assemblages	Slide No.	disaccate quality	Microfloral Zones.		"formations"
18	17	17	14	Lkf.	1778/a	f-g	7		DAPTOCEPHALUS ZONE
			18	Kb.	several	g			
10	10	10	10	GrR.	1574/b	p-f	6		CISTECEPHALUS ZONE
56	33	29	29	OW 94'	1781/B/a	g	5	e	TAPINOCEPHALUS ZONE EQUIVALENT
		30	30	OW 159'	1784/a	p-f		d	
		27	27	OW 170'	1787/a	p-f		c	
		40	40	OW 312'	1794/a	p		b	
		38	38	OW 337'	1796/a	p		a	
61	28	29	25	SAP 7 278'	1234/a	vp	4	e	UPPER ECCA
			26	SAP 7 287'	1235/a	p			
			36	SAP 7 310'	2285/a	vp			
		37	40	SAP 7 338'	2288/a	vp		d	
			35	SAP 7 464'	2291/a	vp			
			37	SAP 6 521'	1167/d	vp			
		25	24	SAP 7 570'	2293/a	vp		c	
			25	SAP 6 688'	1172/a	p			
		26	30	SAP 7 712'	1247/a	p		b	
			21	SAP 6 825'	1178/a	p			
			24	SAP 7 760'	1249/a	p			
			26	SAP 6 876'	1180/a	p			
			28	SAP 7 813'	1250/a	p			
		23	29	SAP 6 927'	1183/a	p		a	
			17	SAP 6 944'	1185/a	vp			
			23	SAP 6 991'	1187/a	p			
106	42	39	40	UC 678 30,6	1894/a	p-f	3	d	MIDDLE ECCA
			48	UC 678 31,6	1895/a	f			
			37	SAP 6 1000'	1188/a	p-f			
			36	SAP 6 1007'6"	2296/B/a	p-f			
			36	SAP 6 1017'	2297/B/a	f			
		52	48	UC 621 153'	1877/a	p-f		c	
			50	UC 678 79,0	1906/g	f-g			
			43	UC 678 80,6	1913/a	f-g			
			67	OW 1145'	1820/B/a	g			
			52	OW 1148'	1821/B/a	f-g			
		41	50	HKr	several	g		b	
			40	G 172 117'	1704/a	f			
			48	P 13 126,50	2467/a	p			
			45	P 13 128,13	2468/a	p			
			29	UC 678 108,6	1919/a	f			
			35	WV3 133,50	1674/B/a	f			
		35	28	A 401 10,05	1641/a	p-f		a	
			44	A 401 30,85	1653/a	p			
			33	A 401 40,30	1659/a	p			
			42	OW 1257'	1826/a	p-f			
			35	UC 678 151,0	1930/a	p-f			
			29	P 13 140,6	2471/a	c			
			44	P 13 146,8	2476/a	p			
			28	P 13 147,7	2475/a	p-f			
77	32	34	31	LA 5349'	2064/a	p	2	d	LOWER ECCA
			39	LA 5379'	2066/a	p			
			32	LA 5395'	2068/a	p			
			34	LA 5419'	2069/a	p			
		40	42	SAP 6 1130'	1199/a	p		c	
			32	SAP 6 1131'	1200/B/a	p-f			
			47	SAP 6 1133'	1201/B/a	f			
		20	21	P 13 152,95	2477 a	f		b	
			20	P 13 153,39	2479 a	p			
			19	P 13 154,35	2482 a	f			
		31	24	SAP 6 1151'3"	1208/B/a	f		a	
			33	SAP 6 1152'3"	1209/B/a	f			
			37	SAP 6 1152'9"	1210/B/a	f			
31	21	21	27	UC 608 1262'	2111/f	p	1		DWYKA
			15	UC 729 504,0	3318/a	p-f			
			22	UC 729 550,0	3322/a	f-g			
			21	UC 608 1590'	1590/a	p			

CHART 4.

KAROO PERMIAN MIOSPORES SAD PATTERNS

For general explanation see text 4.2


MAP I

THE KAROO BASIN

FOSSIL LOCALITES

For notes on data included see text 2.1.2.

9.2 ERRATA

(Relevant to 9.3, 9.4, 9.5)

Species pages

p. 2 - STRATIGRAPHIC TABLE (9 Karoo Basin) - transfer distribution shown for Zone 1 to Zone 2a
p. 3 - TITLE - read irregulare for irregularae
p. 18 - REFERENCE POPULATION & HOLOTYPE - read pl. 8 for pl. 10
p. 19 - LITERATURE - read 14 Perth Basin for 13 Perth Basin
p. 20 - REFERENCE POPULATION - read 154 specimens for 140 specimens
p. 25 - CLOSELY RELATED SPECIES - read *G. lacunatus* for *G. lacunata*
p. 44 - CLOSELY RELATED SPECIES - read *M. pentagonalis* for *M. dwykaensis*
p. 46 - TITLE - read *Granulatisporites* for *Granulatrisporites*
p. 53 - CLOSELY RELATED SPECIES - read *M. grandegranulata* for *M. dwykaensis*
p. 55 - HOLOTYPE - add p. 142
- LITERATURE - read Hart '63, pl. 1(9) for Hart '63, pl. 1(7)
p. 72 - CLOSELY RELATED SPECIES - read *C. verrucosus* for *P. verrucosus*
p. 74 - HOLOTYPE - read p. 112 for pl. 112
p. 82, 83, 84 - DESCRIPTION - read bearing for baring
p. 86 - DESCRIPTION - read coarsely for coasely
p. 88 - CLOSELY RELATED SPECIES - read *P. detritus* for *G. detritus*
p. 92 - HOLOTYPE - read pl. 83(5) for pl. 82(14)
p. 95 - CLOSELY RELATED SPECIES - add *V. walikalensis* $\underline{OO}$; pl. 91(12) - pl. 99(5)
p. 96 - CLOSELY RELATED SPECIES - add *V. walikalensis* $\underline{OO}$; pl. 77(10) - pl. 99(5)
p. 97 - REFERENCE POPULATION - read 13 specimens for 15 specimens
- CLOSELY RELATED SPECIES - read *V. neglectus* for *V. magnus*
p.100 - REFERENCE POPULATION - read 126 specimens for 134 specimens
p.103 - LITERATURE (9 Karoo Basin) - read pl. 126 (12 - 23), pl. 127(1 - 9) for pl. 126 (12 - 13)
p.109 - REFERENCE POPULATION - read 65 specimens for 64 specimens
p.117 - STRATIGRAPHIC TABLE - transfer distribution shown for 7 Zambia to 6 Congo

Annotated bibliography

p.1 - Bharad. & Riw. '64a - read Bharad. & Tiw. '64a
- Tiw. '64 - change numeral I (after G) to letter l
p.3 - 6 - CONGO - Hoeg, O.A. & Bose, M.N. '69 - read '60 for '69
p.7 - 7 - NIDPUR VILLAGE - Bharadwaj, D.C. & Srivastava, S.C. April '69 - read '69a for '69

Photographic catalogue

Chart 5 - Inconsistencies occur regarding the number of specimens representing each population. This is due to certain illustrations including more than 1 specimen, and in a few cases to certain specimens being illustrated twice at different levels of focus. The number of specimens tabulated for the reference populations should where necessary be corrected according to the data given on the 'species pages'; those for the representative populations according to the photographic plates.

Repetitive errors in 9.3 and/or 9.4

(a) read 'species page' for 'specie page'
(b) read Karoo for Karroo
(c) read µm for mu
(d) read HYPODIGM for LITERATURE (on 'species pages')

9.3 SPECIE PAGES

KEY TO THE GEOGRAPHIC MAP & STRATIGRAPHIC TABLE INCLUDED ON EACH 'SPECIE PAGE'.

(Base map & table adapted from Anderson '73)

GEOGRAPHIC DISTRIBUTION of PERMIAN MIOSPORE SPECIES.

a) Solid colour – Permian outcrop
Stippled colour – Permian subsurface

b) The continents are sub-divided into primary regions (numbered 1 to 23). The primary regions are sub-divided into secondary regions (each indicated by an open circle & lettered A, B, C etc.). On each 'specie page' those secondary regions known to yield the species in question are indicated. The titles affixed, in the annotated bibliography, to each primary and secondary region are listed below.

SOUTH AMERICA

1. ARGENTINA
A San Luis P.
2 BOLIVIA
A Cochabamba P.
3 N BRAZIL
A Amazon B
4 PARANA BASIN
A NW subsurface
B NE subsurface
C C subsurface
D. SE subsurface
E. SW subsurface
F NE outcrop
G EC outcrop
H SE outcrop
I Uruguay outcrop

AFRICA

5 ANGOLA
A Gabon
6 CONGO
A Epulu R
B Walikale
C Yumbi/Lubutu
D Kindu/Kalima
E Lukuga
F Luena
G Lufupa
7. ZAMBIA
A Mhukuru Cf
B Ketewaka/Mchuchuma Cf
C Songwe/Kiwira Cf
D N Luangwa V
E M Zambezi V. (Zambia)
F. M Zambezi V (Rhodesia)
8 SW AFRICA
A W Kalahari B
9. KARROO BASIN
A E. Kalahari B
B Waterberg Cf
C Soutpansberg area
D Springbok Flats
E Bethal area
F Vereeniging area
G Welkom area
H Ficksburg area
I Harrismith area
J S C Karroo
K S W Karroo
10. MOCAMBIQUE
11. MADAGASCAR
A N Morondava B
B S Morondava B
C Sakoa B

INDIA

12 SALT RANGE
A Salt Range
B Naini Tal
13 INDIA
A. Malabar Coast
B Kutch
C Godavari V
D Wardha V
E. Satpura region
F. SE Mahanadi V.
G NW Mahanadi V
H Son V
I W Damodar V
J E. Damodar V

AUSTRALASIA

14 PERTH BASIN
A Collie B
B N Perth B
15. CARNARVON BASIN
A N Carnarvon B.
16 CANNING BASIN
A Canning B
17 S AUSTRALIA
A Pedirka B
B N Arckaringa B
C S Arckaringa B
D Eucla B
E Troubridge B
F Coleraine
G Yandoit Hill
H Bacchus Marsh
18 QUEENSLAND
A SW Cooper B
B NE Cooper B
C N Galilee B
D S Galilee B
E N Bowen B
F S Bowen B
G Clarence/Moreton B
19 SYDNEY BASIN
A New England
B N Sydney B
C Hunter V
D S Sydney B
20 TASMANIA
A Tasmania
21. NEW ZEALAND

ANTARCTICA

22 TR ANTARCTIC MTS
A George V Land
B Victoria Land
C Ohio Range
23 ANTARCTICA
A Prince Charles Mts

STRATIGRAPHIC DISTRIBUTION of PERMIAN MIOSPORE SPECIES.

a) The columns represent generalised stratigraphic sections for each of the 23 primary regions

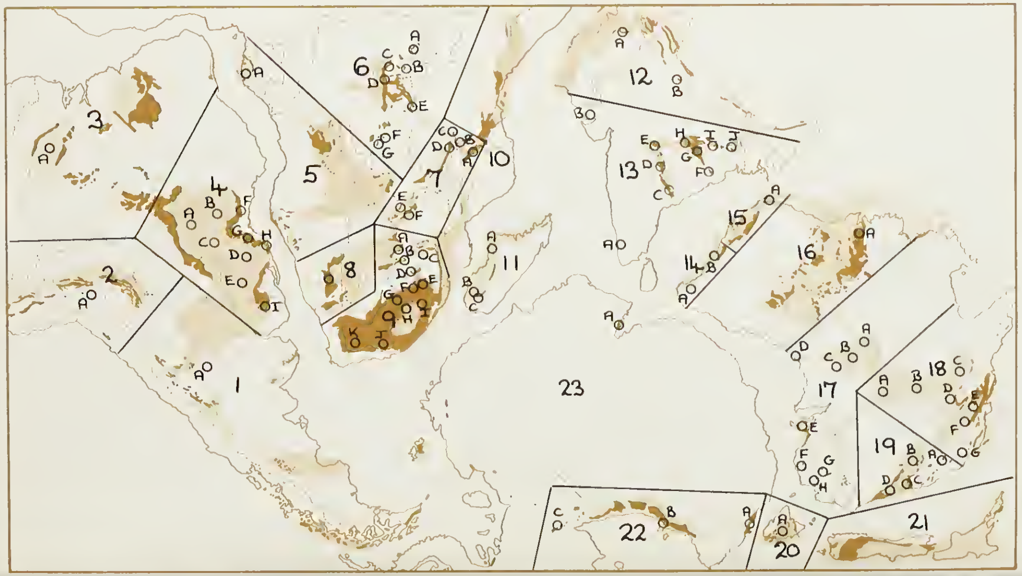
b) Stippled colour – strata preserved.
Blank areas – no strata preserved.
nb. In those columns marked by ? either no attempt has been to indicate the preserved strata (in these primary regions either no palynological data is available or is of such a preliminary nature that no attempt has been made in this paper to plot the geographic or stratigraphic distribution of the contained species); or only those strata for which palynological data is available are indicated.

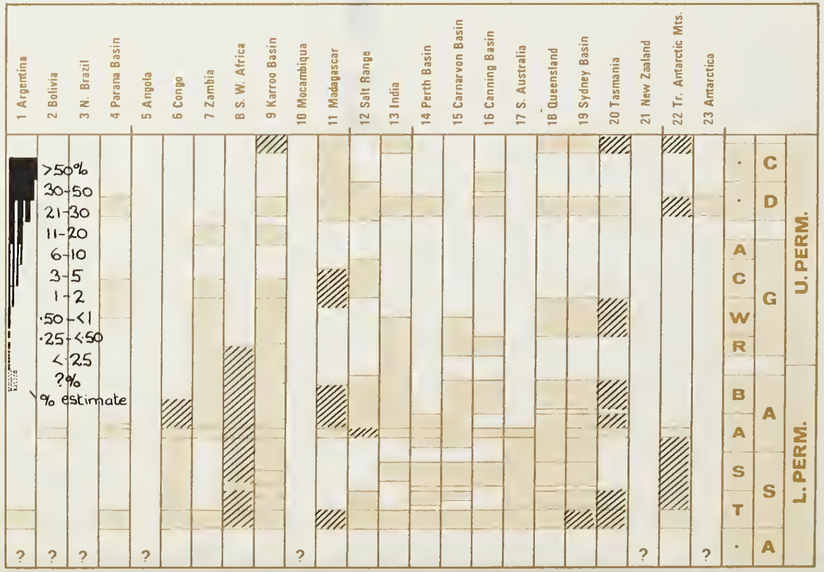
c) The 3 columns at the right represent the standard reference series, stages & sub-stages of the Permian System.

Stages		Sub-stages	
C	Changhsingian	A	Amarassian
D	Dzhulfian	C	Capitanian
G	Guadalupian	W	Wordian
A	Artinskian	R	Roadian
S	Sakmarian	B	Baigendzhinian
A	Asselian	A	Aktastinian
		S	Sterlitamakian
		T	Tastubian

d) Those strata for which no palynological data are available are indicated by black shading (nb. this shading is not repeated on each of the 'specie pages')

e) The key to % frequency distribution of species is given in column 1. (nb. a small diagonal stroke in top right corner indicates that the % is estimated from the data given in the literature. In most papers no frequency data is given or is inadequate to enable a % estimate to be made).





Mehlisphaeridium parvum sp. nov.

Spongocystia eraduica Segr.'67

REFERENCE POPULATION . This paper, pl.1(1-8), 8 specimens.
REFERENCE LOCALITY . S.Africa, northern Karroo Basin, Greylingstad/Bethal/Hendrina area. Borehole, UC 678, 31,6m., M.Ecca.

HOLOTYPE . . . . . . This paper, pl.1(6).
TYPE LOCALITY . . . . As for reference locality.

NAME DERIVATION . . . L. parvum = small; (overall size).

DESCRIPTION (ref. pop.)

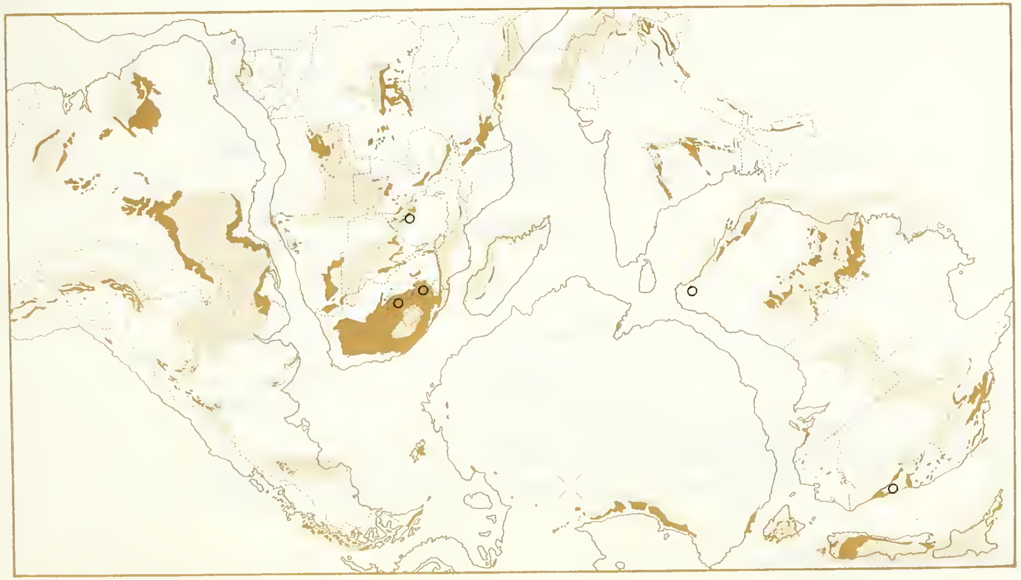
Shape . . . . . . } as for genus.
Dehiscence . . . . . } as for genus.
Exine . . . . . . } as for genus.
Ornament. Arrangement } as for genus.
Description . Hollow, setate to baculate processes (1 mu high).
Size . . . . 28(33)38.

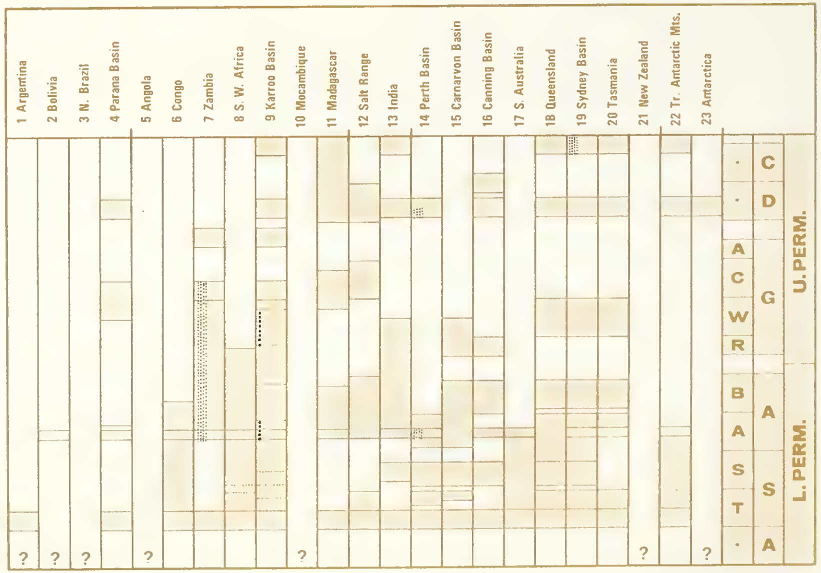
CLOSELY RELATED SPECIES

M.regulare . . . . . ꝏ; pl.1(9) - pl.1(21).

LITERATURE:

7	Zambia . . .	Falc.'72, pl.5(5-12).
9	Karroo Basin .	This paper, pl.1(1-10).
14	Perth Basin . .	Glick.'72, pl.2(1-5).
19	Sydney Basin .	Helby'70, pl.42(7-18).





Mehlisphaeridium regulare sp. nov.

REFERENCE POPULATION .	This paper, pl.1(11-20), 10 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Greylingstad/Bethal/Hendrina area. Borehole, UC 678, 78,9m. - 79,0m., M.Ecca.
HOLOTYPE	This paper, pl.1(18).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION . . .	L. regulare = regular; (ornamentation).

DESCRIPTION (ref. pop.)

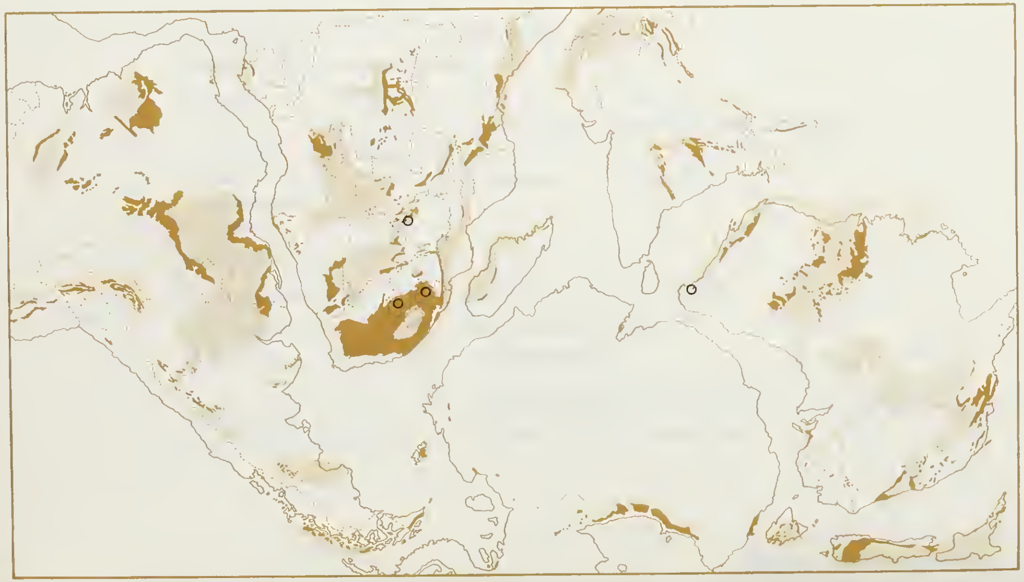
Shape	as for genus.
Dehiscence	as for genus.
Exine	as for genus.
Ornament. Arrangement	as for genus.
Description .	Hollow, baculate to pilate processes (2mu high).
Size	36(50) 64.

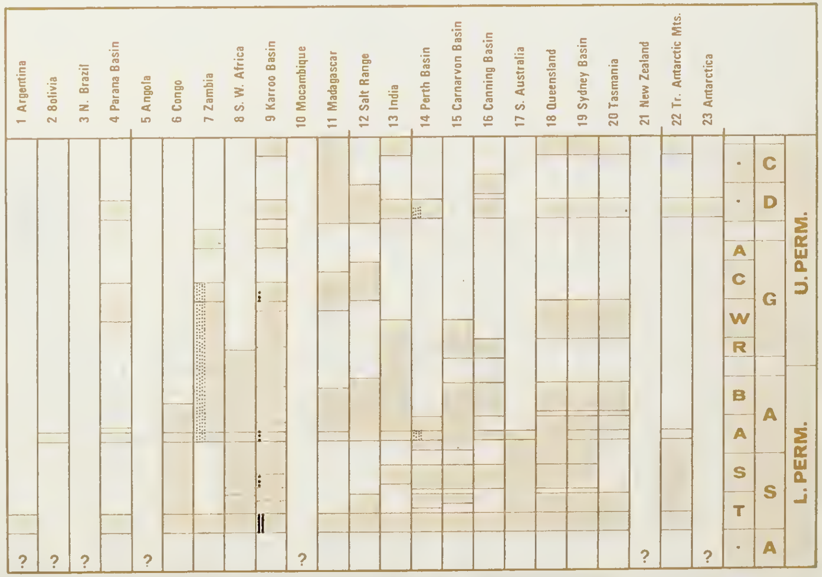
CLOSELY RELATED SPECIES

M.parvum	⚭; pl.1(21) - pl.1(9).
M.irregulare	⚭; pl.1(17) - pl.1(32).

LITERATURE:

7	Zambia . . .	Falc.'72, pl.5(13-16).
9	Karroo Basin .	This paper, pl.1(11-30).
14	Perth Basin . .	Glick.'72, pl.2(6-12).





Mehlisphaeridium irregularae sp. nov.

REFERENCE POPULATION	.	This paper, pl.1(31-52), 22 specimens.
REFERENCE LOCALITY	.	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1130', L.Ecca equivalent.
HOLOTYPE	. . . . . .	This paper, pl.1(50).
TYPE LOCALITY	. . . .	As for reference locality.
NAME DERIVATION	. . .	L. irregulare = irregular; (ornamentation).

DESCRIPTION (ref. pop.)

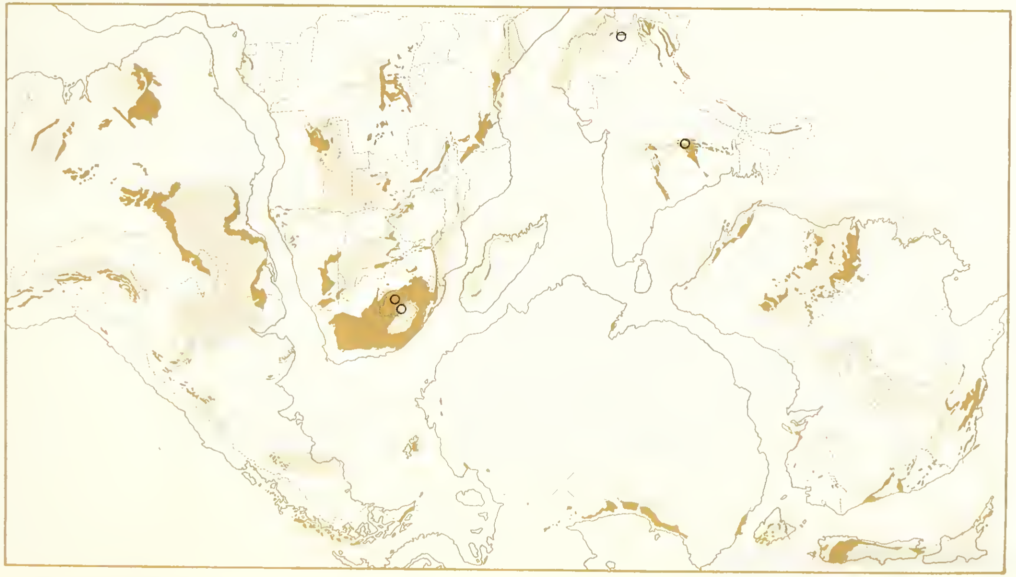
Shape	. . . .	as for genus.
Dehiscence	. . . . . .	as for genus.
Exine	. . . .	as for genus.
Ornament. Arrangement		as for genus.
Description	.	Hollow, very irregularly shaped processes (4 to 5mu high).
Size	. . . .	30(40)50.

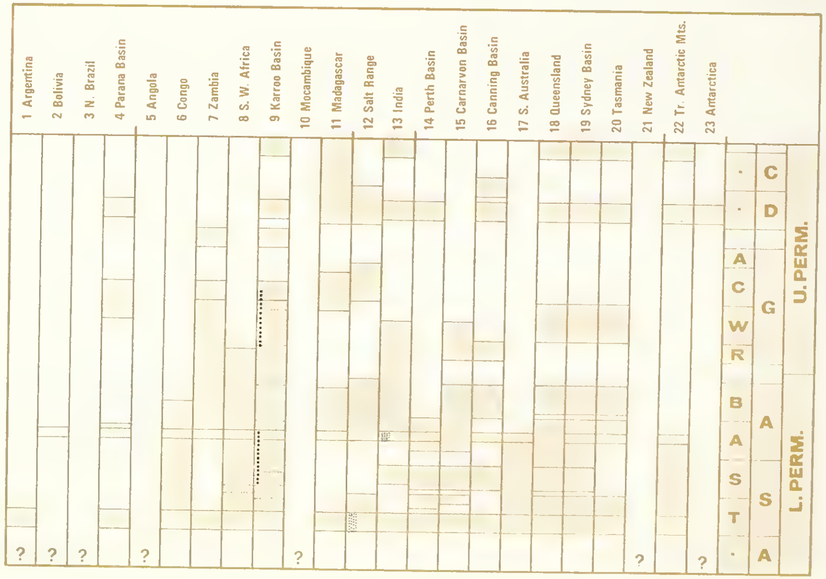
CLOSELY RELATED SPECIES

M.regulare	. . . . .	ꝏ; pl.1(32) - pl.1(17).
M.fibratum	. . . . .	ꝏ; pl.1(51) - pl.1(56).

LITERATURE:

9	Karroo Basin	.	This paper, pl.1(31-52).
12	Salt Range	.	Kemp (in press), pl.2(9,10).
13	India . . .	.	Sinha'69, pl.1(3); Tiw. & Moiz'71, pl.1(40-44).





Mehlisphaeridium fibratum Segr.'67.

REFERENCE POPULATION .	Segr.'67, pl.2(9-14), 4 specimens.
REFERENCE LOCALITY .	W.Australia, Canning Basin. Borehole, Dampier Downs No.1, 1080'-1090', Poole Sdst. or lowest Noonkanbah.
HOLOTYPE	Original designation, Segr.'67, pl.2(13,14), p.296.
TYPE LOCALITY	As for reference locality.
NAME DERIVATION . . .	L. fibratum = fibrous; (ornamentation).

DESCRIPTION (ref. pop.)

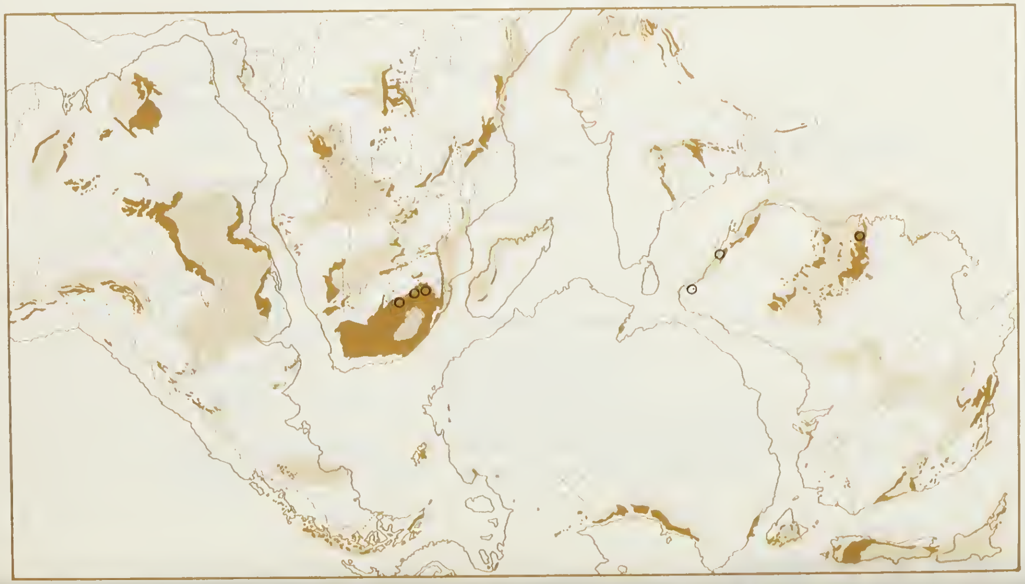
Shape		as for genus.
Dehiscence		
Exine		
Ornament.	Arrangement	
	Description .	Hollow, coarse, cones (up to 30mu high).
Size		60 (80) 100.

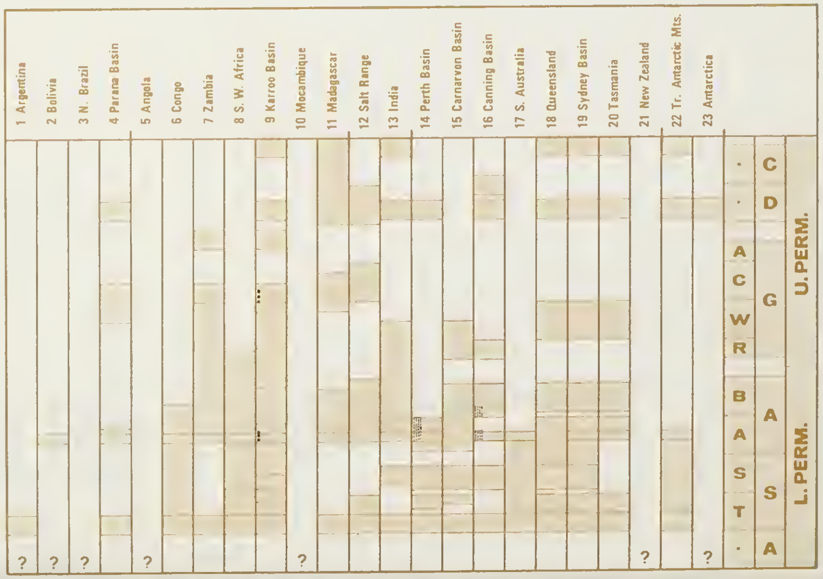
CLOSELY RELATED SPECIES

M.irregulare	ꝏ; pl.1(56) - pl.1(51).

LITERATURE:

9	Karroo Basin .	This paper, pl.1(53-56).
14	Perth Basin . .	Glick.'72, pl.2(13-18); (Segr.'67).
16	Canning Basin .	Segr.'67, pl.2(8-14); Segr.'72, pl.5(11).





Mehlisphaeridium gondwanensis (Tiw.'65) comb. nov.

Maculatasporites gondwanensis Tiw.'65

REFERENCE POPULATION .	This paper, pl.2(1-13), 13 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1130', L.Ecca equivalent.
HOLOTYPE	Original designation, Tiw.'65, pl.8(192), p.205.
TYPE LOCALITY	India (M.P.), Korba Coalfield 202 (3 seam) E. Borehole, R-34, ? depth, Barakar Stage.
NAME DERIVATION . . .	After Gondwanaland.

DESCRIPTION (ref. pop.)

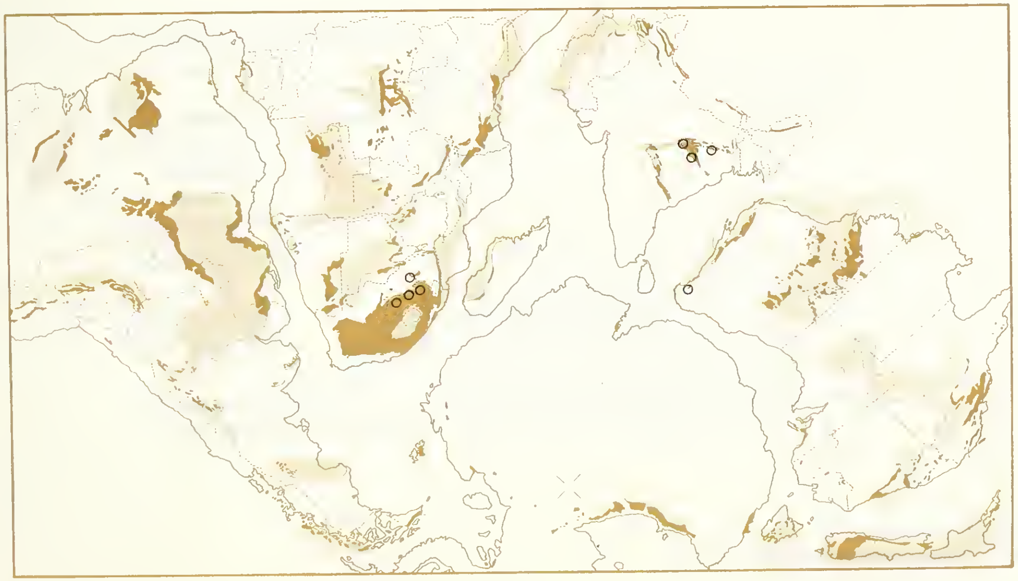
Shape		as for genus.
Dehiscence		as for genus.
Exine		as for genus.
Ornament.	Arrangement	as for genus.
	Description .	Hollow, reticulate processes (2mu high).
Size		24(30)36.

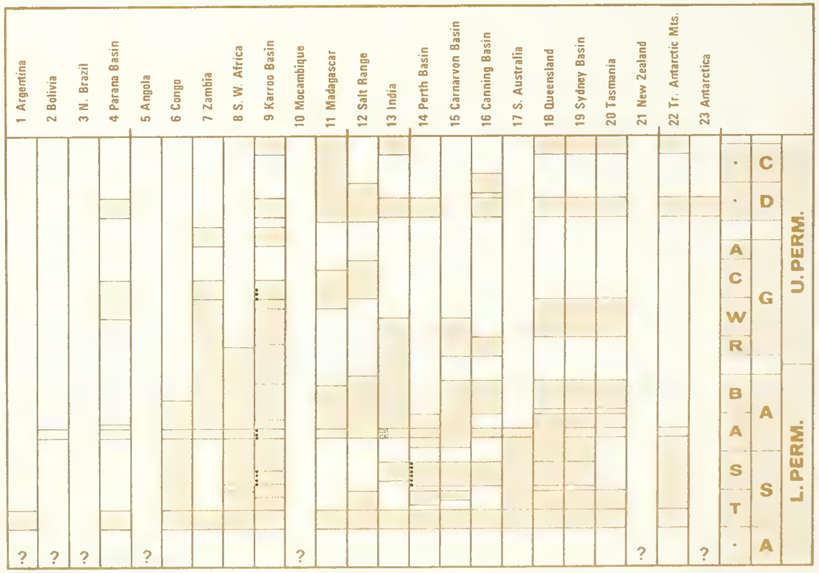
CLOSELY RELATED SPECIES

—

LITERATURE

9	Karroo Basin .	Hart'63a, pl.1(11); This paper, pl.2(1-44).
13	India	Tiw.'65, pl.8(191,192); Saks.'71, pl.1(20).
14	Perth Basin . .	Glick.'72, pl.1(1-3).





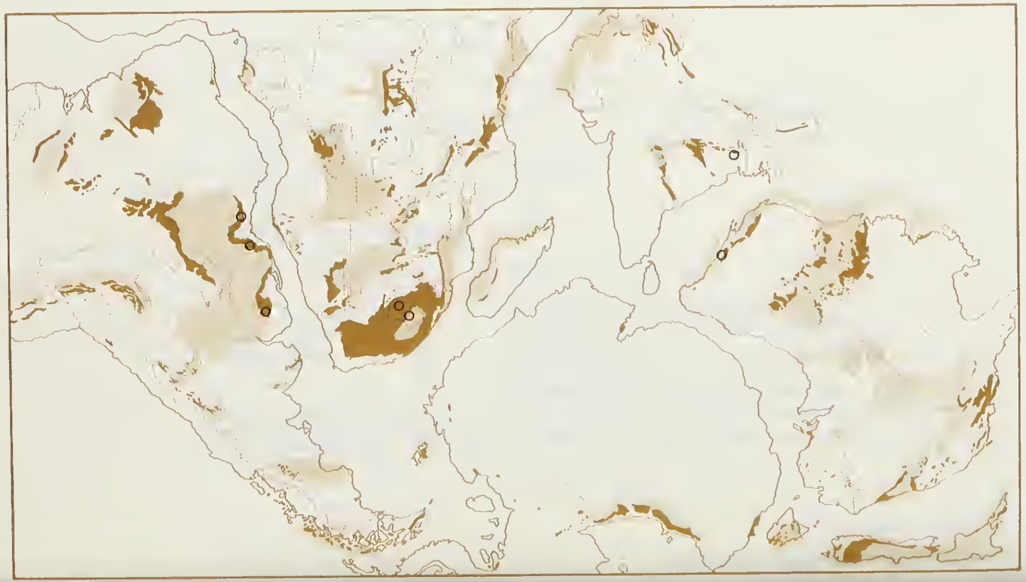
Maculatasporites eraduensis (Segr.'67) comb. nov.

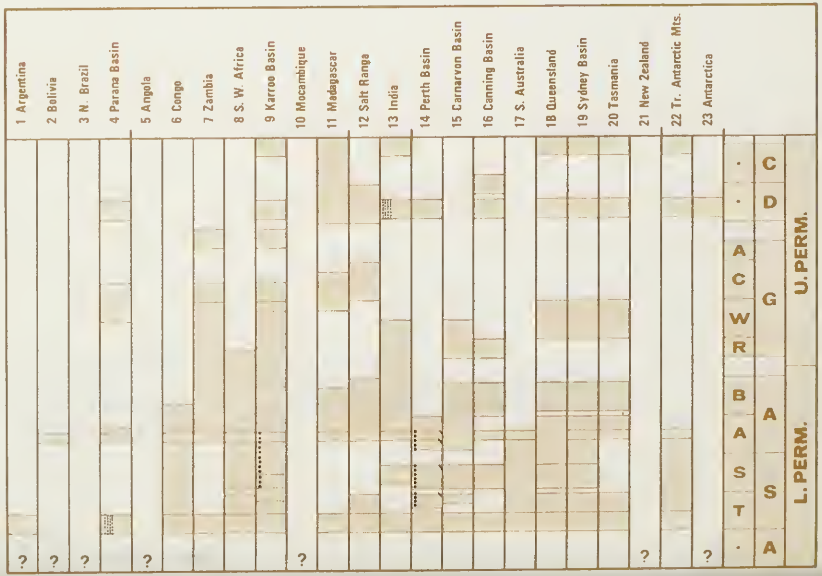
Spongocystia eraduica Segr.'67

REFERENCE POPULATION	This paper, pl.3(1-8), 8 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1133', L.Ecca equivalent.
HOLOTYPE	Original designation, Segr.'67, pl.3(6,7), p.297.
TYPE LOCALITY	W.Australia, northern Perth Basin. Borehole, Kockatea Creek No.21, 46 - 66', 'Artinskian'.
NAME DERIVATION	After Eradu, village in northern Perth Basin, W.Australia.
DESCRIPTION (ref. pop.)	
Shape	as for genus.
Dehiscence	as for genus.
Exine	as for genus.
Ornament. Arrangement	as for genus.
Ornament. Description	Very finely foveolate (lumina 1/10 to 1/5 mu in diameter).
Size	42 (56) 78.
CLOSELY RELATED SPECIES	-

LITERATURE:

4	Parana Basin	Bharad.'69, pl.2(53,54); Kemp (in press), pl.1(18,19).
9	Karroo Basin	This paper, pl.3(1-8).
13	India	Bharad. & Sal.'65, pl.1(1).
14	Perth Basin	Segr.'67, pl.3(6-10); Segr.'72, pl.3(4).





Maculatosporites indicus Tiw.'64

REFERENCE POPULATION .	This paper, pl.3(18-28), 11 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1130', L.Ecca equivalent.
HOLOTYPE	Original designation, Tiw.'64, pl.1(11), p.258.
TYPE LOCALITY	India (M.P.), Korba Coalfield, 495(C). Borehole, G-44, ? depth, Barakar Stage.
NAME DERIVATION . . .	After India.

DESCRIPTION (ref. pop.)

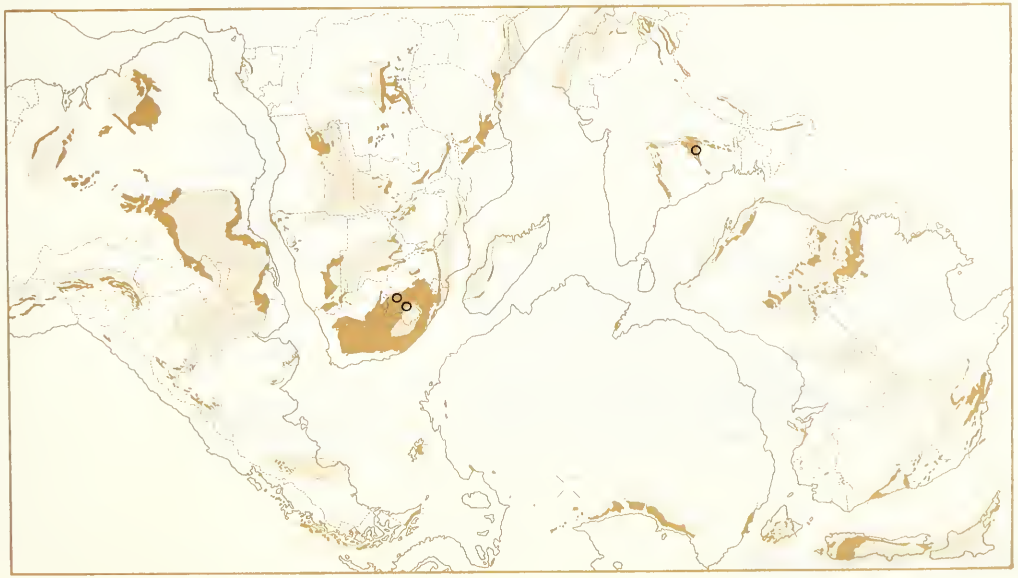
Shape		as for genus.
Dehiscence		as for genus.
Exine		as for genus.
Ornament.	Arrangement	as for genus.
	Description .	Foveolate (1 to 1½mu in diameter)
Size		32(39)46.

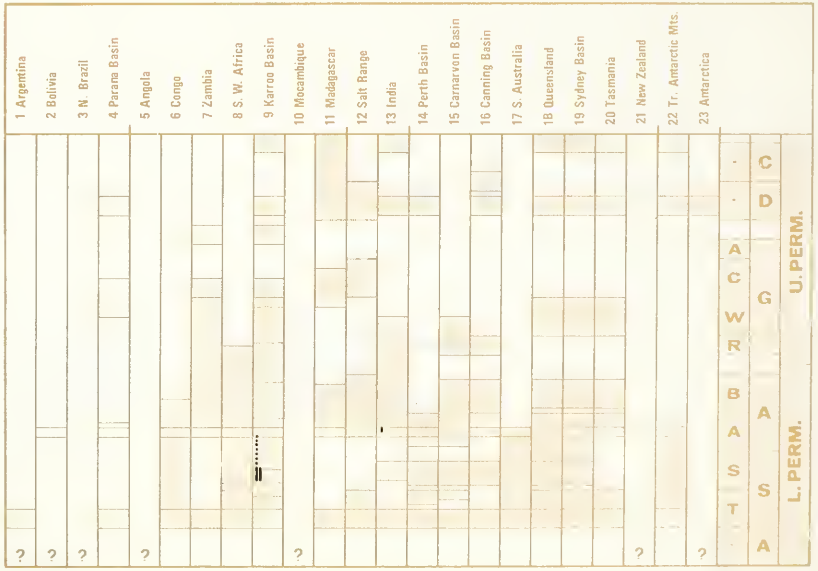
CLOSELY RELATED SPECIES

M.minimus . . . . . . ⊕; pl.3(28) - pl.3(32).

LITERATURE:

9	Karroo Basin .	This paper, pl.3(9-28).
13	India	Tiw.'64, pl.1(11,12); Bharad. & Tiw.'64b, pl.2(21); Tiw.'65, pl.8(187-190).





Maculatasporites minimus Segr.'67

REFERENCE POPULATION .	This paper, pl.3(29-32), 4 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1152'9", L. Ecca equivalent.
HOLOTYPE	Original designation, Segr.'67, pl.3(11,12), p.298.
TYPE LOCALITY	W.Australia, Canning Basin. Borehole, Dampier Downs No.1, 1080 - 1090', 'Artinskian'.
NAME DERIVATION . . .	L. minimus = smallest; (relative overall size).

DESCRIPTION (ref. pop.)

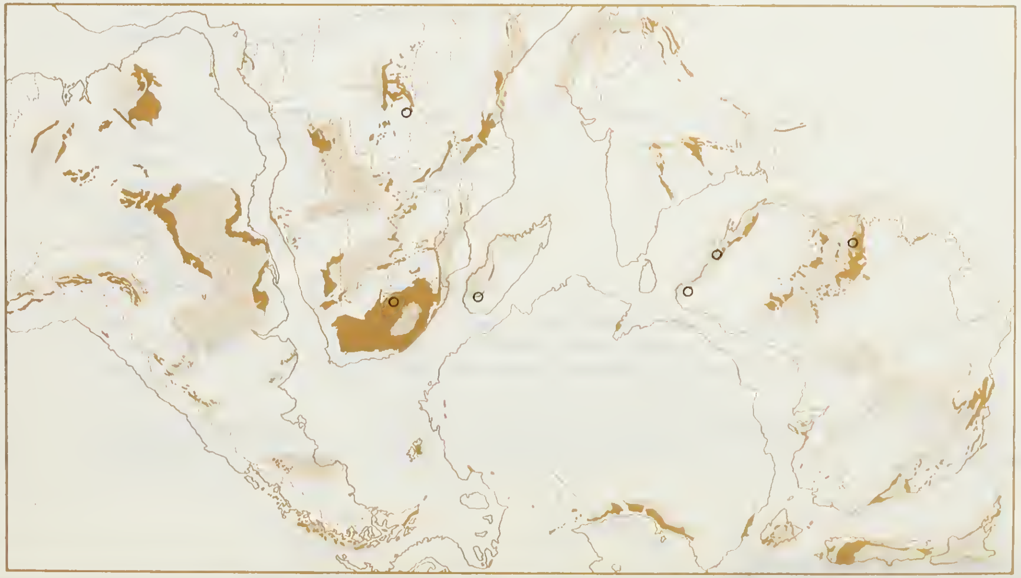
Shape		as for genus.
Dehiscence		as for genus.
Exine		as for genus.
Ornament.	Arrangement	as for genus.
	Description .	Coarsely foveolate (2 to 3mu in diameter)
Size		36(39) 42.

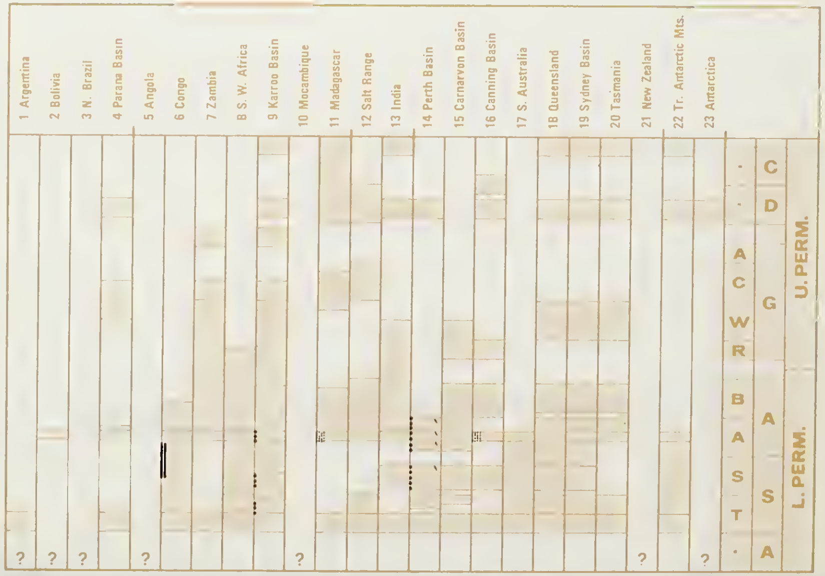
CLOSELY RELATED SPECIES

M.indicus	O̲D̲; pl.3(32) - pl.3(28).

LITERATURE:

6	Congo . . .	Bose & Mahesh.'68, pl.20(3,4).
9	Karroo Basin .	This paper, pl.3(29-32).
11	Madagascar . .	Rakoto.'70, pl.22(3).
14	Perth Basin . .	Glick.'72, pl.1(4-5); (Segr.'67).
16	Canning Basin .	Segr.'67, pl.3(11-14).





Circulisporites venosus (Balme & Segr.'66) comb. nov.

Peltacystia venosa Balme & Segr.'66

REFERENCE POPULATION . Balme & Segr.'66, fig.3(g,j,k), 3 specimens; see also Segr.'67, pl.3(1,2).

REFERENCE LOCALITY . W.Australia, northern Perth Basin.
Borehole, U.W.A.4 (Woolaga Creek) 91' - 95', Wagina Sdst.

HOLOTYPE . . . . Original designation, Balme & Segr.'66, pl.3(k), p.27.

TYPE LOCALITY . . . . As for reference locality.

NAME DERIVATION . . . L. venosus = veined; (ornamentation).

DESCRIPTION (ref. pop.)

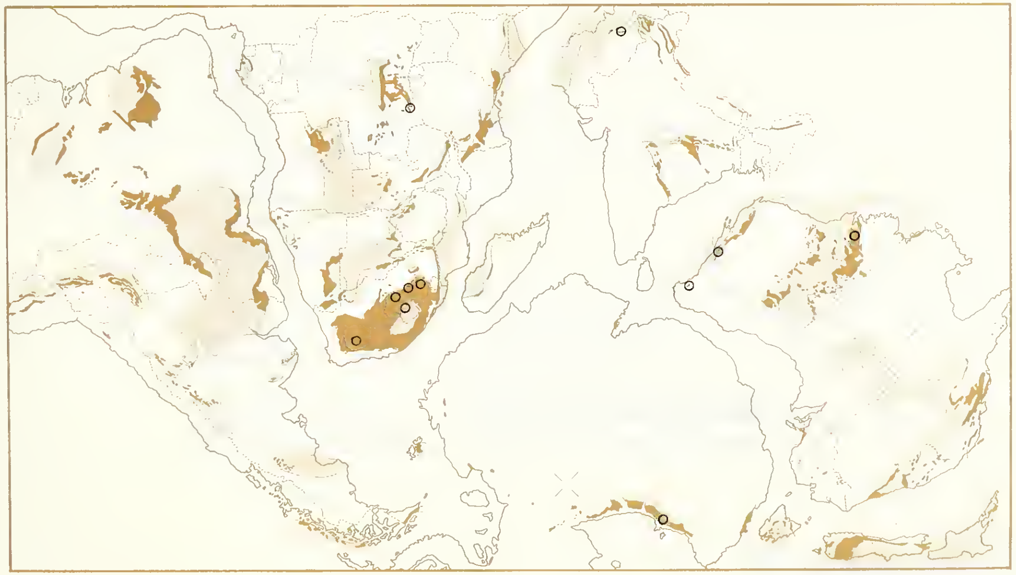
Shape		as for genus
Dehiscence		as for genus
Exine		as for genus
Ornament.	Arrangement	as for genus
	Description .	3 concentric, baculate, circular ridges, plus anastomosing radial ridges.
Size		54 (57) 60.

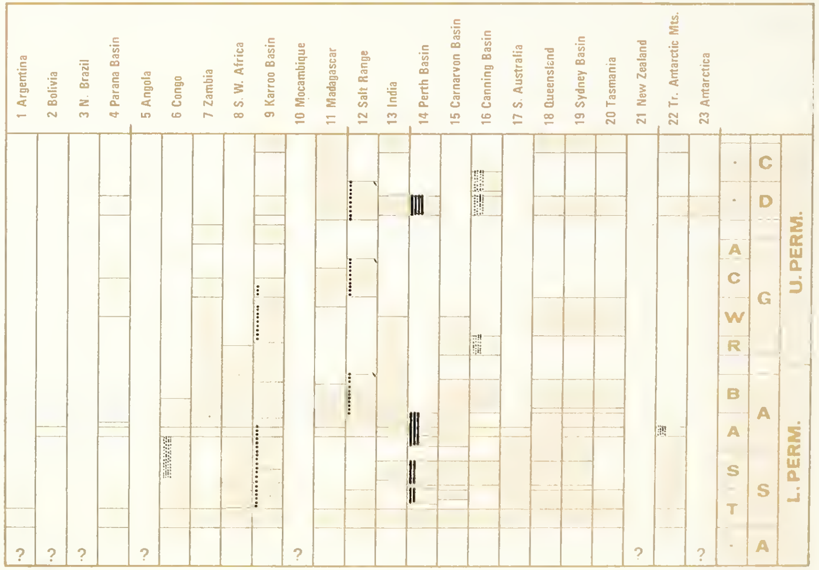
CLOSELY RELATED SPECIES

—

LITERATURE

6	Congo . . .	Bose & Mahesh.'68, pl.23(10-13).
9	Karroo Basin .	This paper, pl.4(1-15).
12	Salt Range . .	Balme'70, pl.22(3-6).
14	Perth Basin . .	Balme & Segr.'66, pl.1(a-e); Segr.'67, pl.3(1,2); Segr.'72, pl.7(9); Glick.'72, pl.3(1-3).
16	Canning Basin .	(Balme & Segr.'66; Segr.'67).
22	Tr.Antarctic Mts.	(Kyle'73 letter).





Circulisporites bianularis sp. nov.

REFERENCE POPULATION .	This paper, pl.4(16-28), 13 specimens.
REFERENCE LOCALITY .	S.Africa, central Transvaal, Springbok Flats. Surface locality, HKr., M.Ecca.
HOLOTYPE	This paper, pl.4(19).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION . . .	L. bis = twice; L. anularis = ringed; (ornamentation).

DESCRIPTION (ref. pop.)

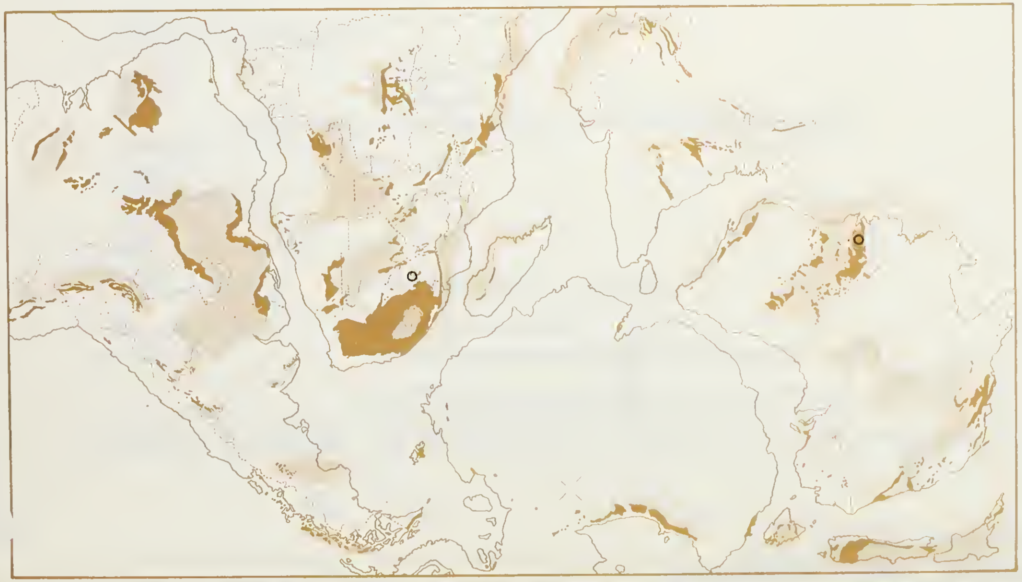
Shape		as for genus
Dehiscence		
Exine		
Ornament.	Arrangement	
	Description .	2 concentric circular ridges
Size		26(29)32.

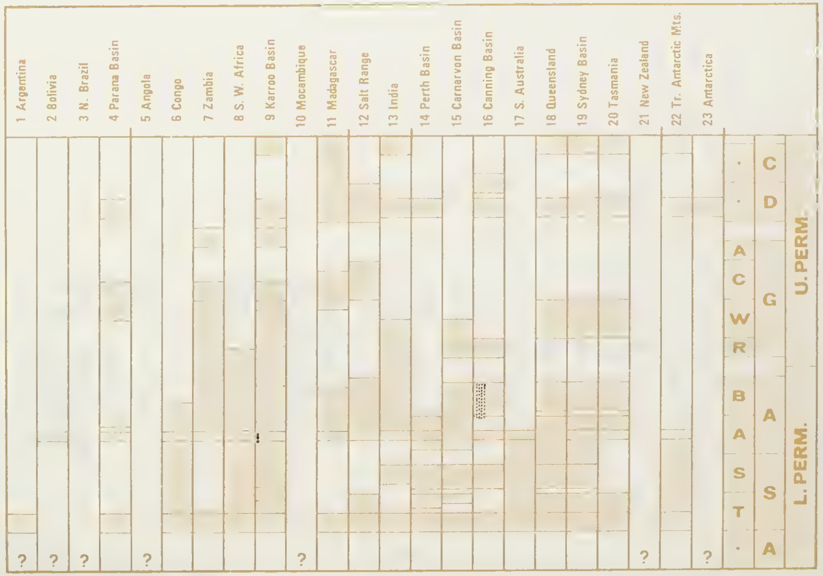
CLOSELY RELATED SPECIES

—

LITERATURE

9	Karroo Basin .	This paper, pl.4(16-28).
16	Canning Basin .	Balme'73, pl.3(20).





Circulisporites parvus deJers.'62

REFERENCE POPULATION .	This paper, pl.4(29-37), 9 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, OW, 1171', M.Ecca equivalent.
HOLOTYPE	Original designation, deJers.'62, pl.5(13,14), p.15.
TYPE LOCALITY	Queensland, Ipswich Coalfield. Borehole, N.S. 188, 1340'½" - 1,345'8¾", Ipswich Coal Measures.
NAME DERIVATION . . .	L. parvus = small; (overall size).

DESCRIPTION (ref. pop.)

Shape		as for genus.
Dehiscence		as for genus.
Exine		as for genus.
Ornament.	Arrangement	as for genus.
	Description .	±8 concentric circular ridges.
Size		16(19)22.

CLOSELY RELATED SPECIES

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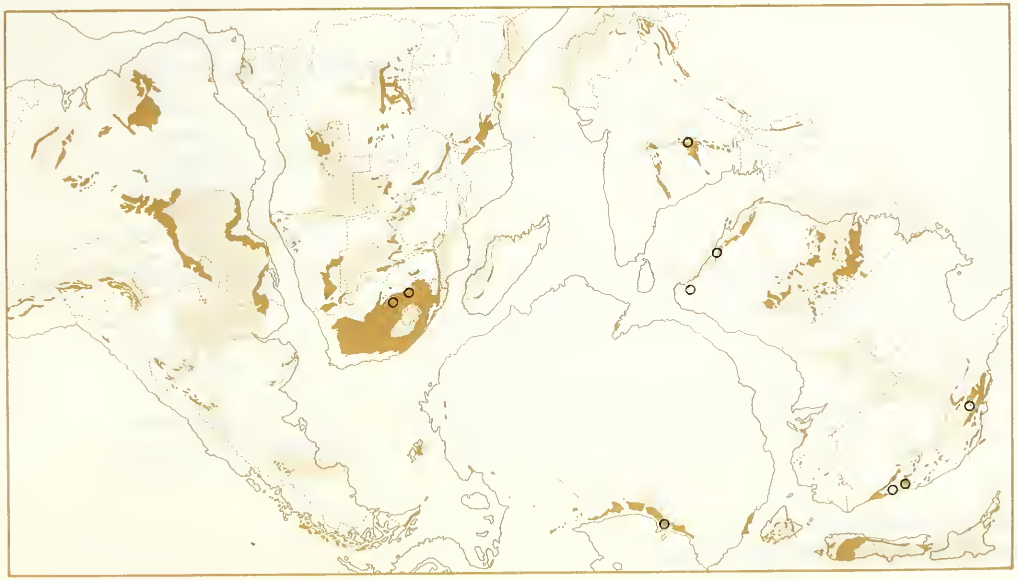
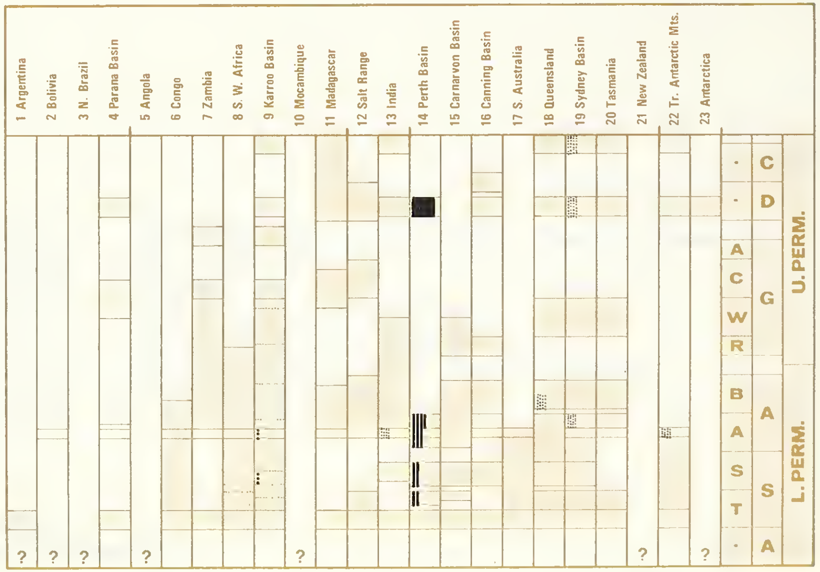
LITERATURE

9	Karroo Basin .	This paper, pl.4(29-45).
13	India	Sinha'69, pl.1(10).
14	Perth Basin . .	Segr.'67, pl.2(7); Segr.'72, pl.7(3); Glick.'72, pl.3(8-10).
18	Queensland . .	(Pat.'65).
19	Sydney Basin .	Helby'70, pl.43(7-11); (Evans'67b).
22	Tr. Antarctic Mts.	(Kyle'73 letter).





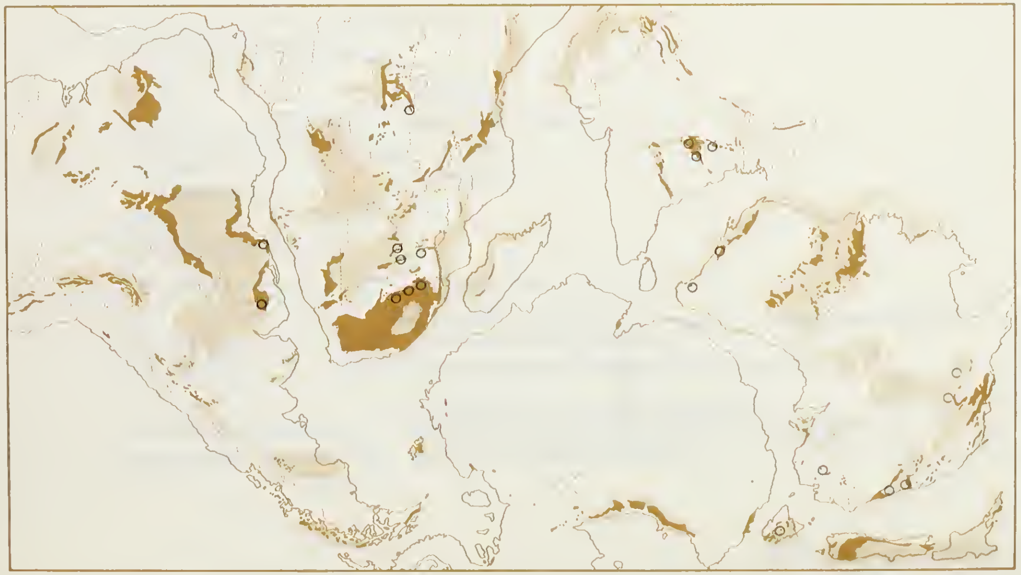
Pilasporites scissus (Balme & Henn.'56) comb. nov.

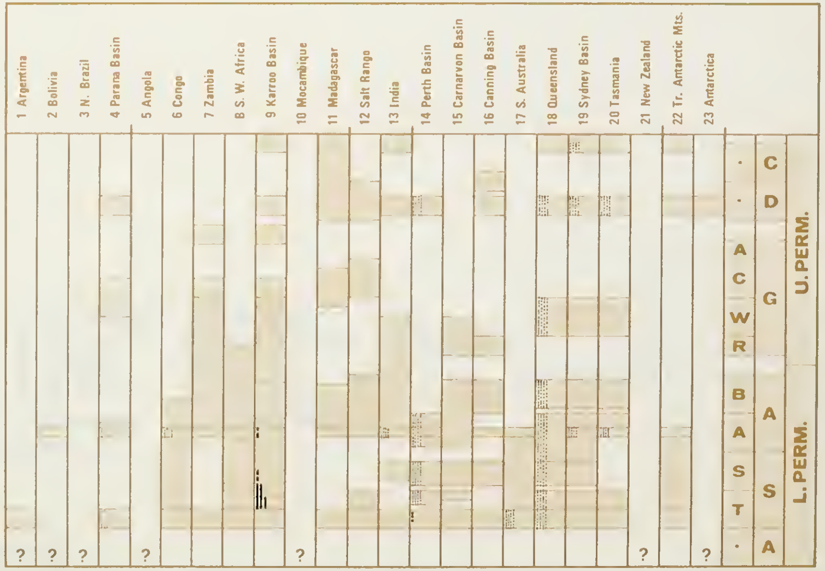
Laevigatosporites scissus Balme & Henn.'56

REFERENCE POPULATION .	This paper, pl.5(1-11), 11 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1152'3'', L.Ecca equivalent.
HOLOTYPE	Not designated to date.
TYPE LOCALITY	N.S.W., Sydney Basin. Hebburn No.2 Colliery, Greta seam, Greta Coal Measures.
NAME DERIVATION . . .	L.scissus = torn, split; (characteristic splitting).
DESCRIPTION (ref. pop.)	
Shape	as for genus.
Dehiscence	
Ornament. Description .	
Exine	Single layered (± 1/10 mu thick).
Size	16(18)20.
CLOSELY RELATED SPECIES	
P.calculus	ꝏ; pl.5(18) - pl.5(38).

LITERATURE

4	Parana Basin . .	Tiw. & Nav.'67, pl.3(47-49).
6	Congo . . .	Bose & Mahesh.'68, pl.23(8).
9	Karroo Basin .	Hart,'63, pl.1(10,12); This paper, pl.5(1-24); (Hart '66b).
13	India	Tiw.'65, pl.9(202,210,211); Sinha '69, pl.1(12,13).
	Australia . .	Balme & Henn.'56a, pl.1(6-9), pl.3(57-59).
14	Perth Basin . .	Glick.'72, pl.3(7); (Balme & Henn.'56a).
17	S.Australia . .	(Doug.'69).
18	Queensland . .	(Norv.'71; Rig.'73).
19	Sydney Basin .	Dulh.'45, pl.7(3C,5C); Helby '70, pl.42(4-6); (Balme & Henn.'56a).
20	Tasmania . .	(Balme & Henn.'56a; Banks & Naqvi '67).





Pilasporites calculus Balme & Henn.'56

REFERENCE POPULATION . This paper, pl.5(25-36), 12 specimens.
REFERENCE LOCALITY . S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1152'3" to 1152'9", L.Ecca equivalent.

HOLOTYPE . . . . Not designated to date.
TYPE LOCALITY . . . . N.S.W., Sydney Basin. Hebburn No.2 Colliery, Greta seam, Greta Coal Measures.

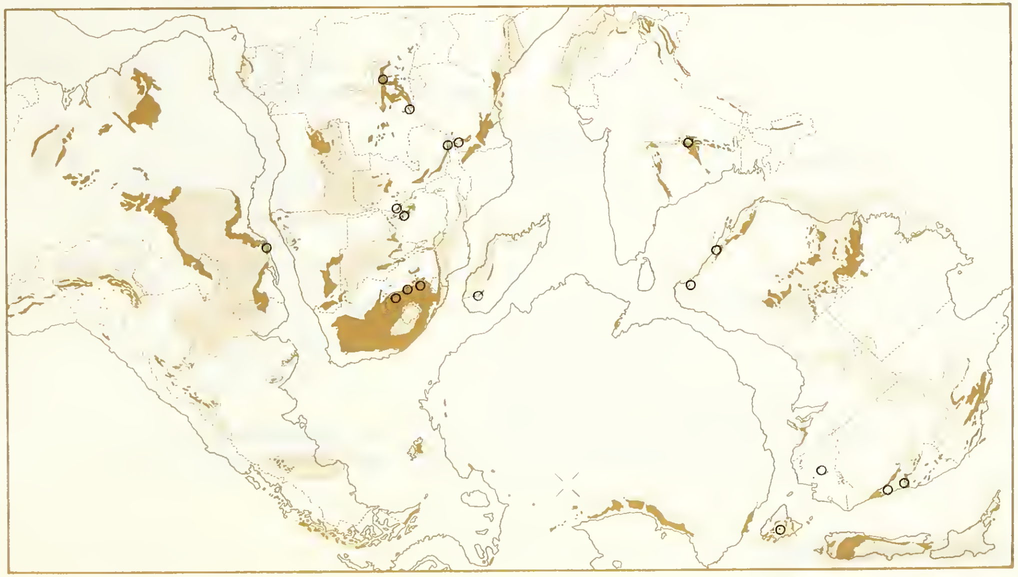
NAME DERIVATION . . . L. calculus = small stone; (overall appearance).

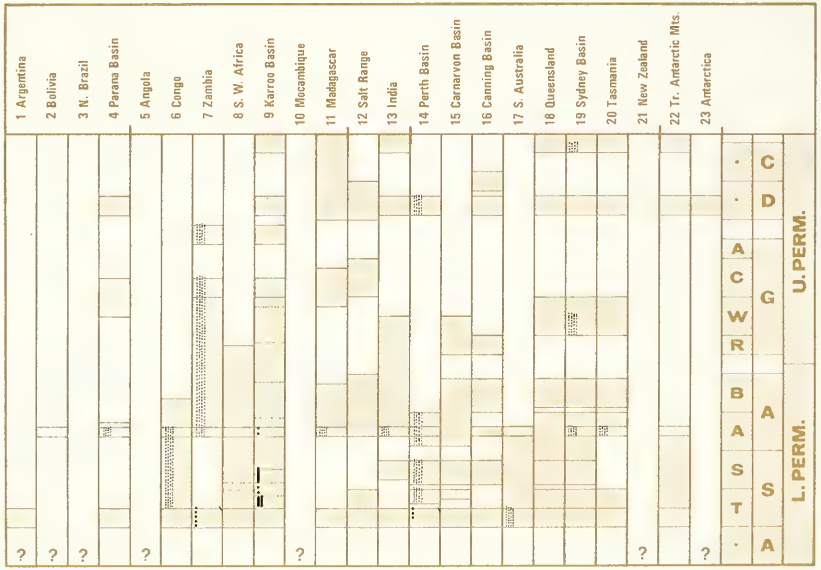
DESCRIPTION (ref. pop.)
Shape . . . . as for genus.
Dehiscence . . . . . as for genus.
Ornamentation . . . . as for genus.
Exine . . . . Single layered (2mu thick).
Size . . . . 34(43)52.

CLOSELY RELATED SPECIES
P.scissus . . . . ꝏ; pl.5(38) - pl.5(18).

LITERATURE

4	Parana Basin	Tiw. & Nav.'67, pl.3(42-46).
6	Congo	Bose & Kar'66, pl.30(20); Bose & Mahesh.'68, pl.22(3,4,8-10), pl.23(9); Mahesh. & Bose'69, pl.4(11), pl.9(8,13,14).
7	Zambia	Hart'60, pl.3(43); Falc.'72, pl.5(1,2); (Utt.'70).
9	Karroo Basin	This paper, pl.5(25-63).
11	Madagascar	Rakoto.'70, pl.22(1,2).
13	India	Sinha'69, pl.1(7-9,14,15).
	Australia	Balme & Henn.'56a, pl.3(60-65).
14	Perth Basin	Segr.'67, pl.1(5,6); Segr.'72, pl.7(5); Glick.'72, pl.1(11-13), pl.3(4-6).
17	S.Australia	(Doug.'69).
19	Sydney Basin	(Helby'70, pl.42(43); (Balme & Henn.'56a; Evans67b).
20	Tasmania	(Balme & Henn.'56a; Banks'62).





Tetraporina simplex sp. nov.

REFERENCE POPULATION .	This paper, pl.6(1-7), ± 45 specimens.
REFERENCE LOCALITY .	S.Africa, central Transvaal, Springbok Flats. Surface locality, HKr., M.Ecca.
HOLOTYPE	This paper, pl.6(3).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION . . .	L. simplex = simple; (overall appearance).

DESCRIPTION (ref. pop.)

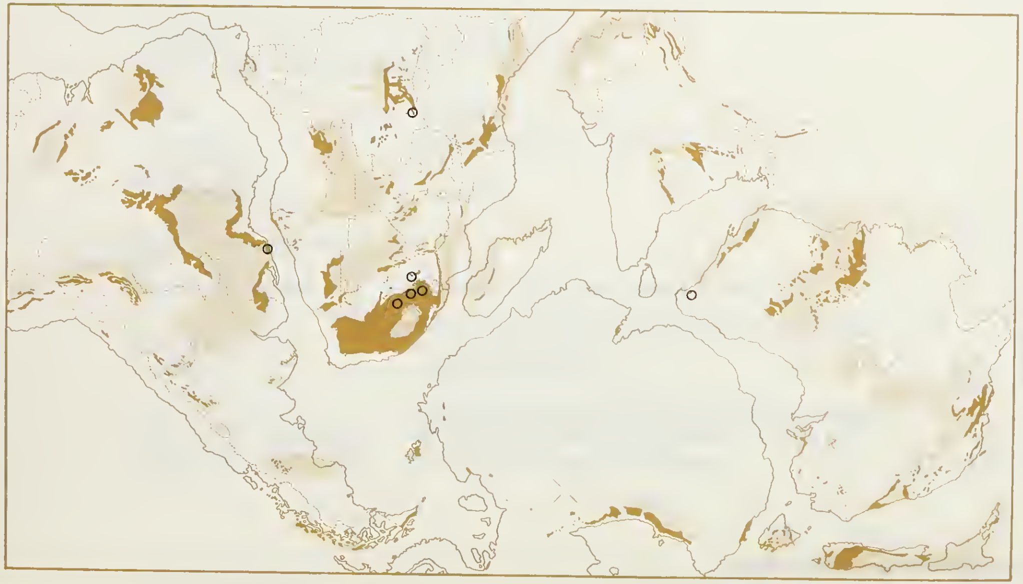
Shape	as for genus.
Exine	as for genus.
Ornamentation	as for genus.
Dehiscence	Porate (pores indistinct, ? 3-4mu in diameter).
Size	32(36)40.

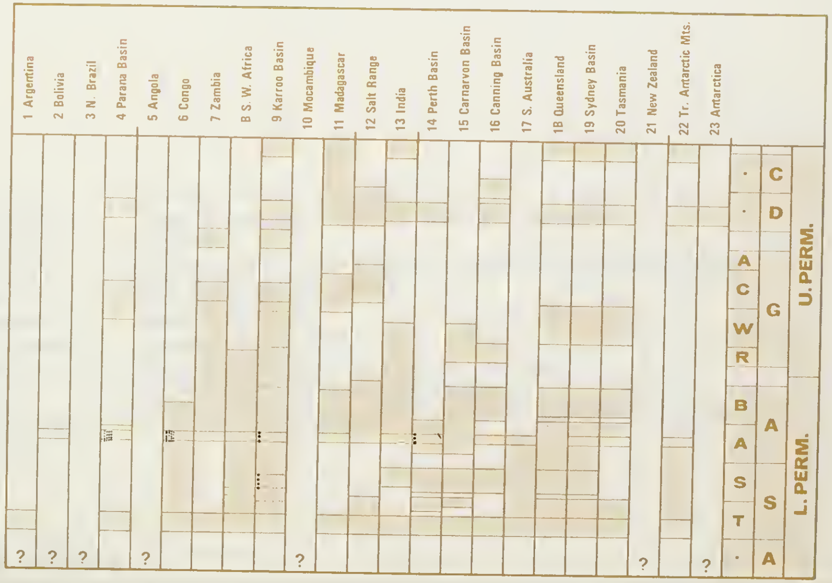
CLOSELY RELATED SPECIES

T.tetragona	OO; pl.6(11) - pl.6(13).

LITERATURE

4	Parana Basin . .	Tiw. & Nav.'67, pl.3(37,40,41).
6	Congo . . .	Bose & Mahesh.'68, pl.23(3).
9	Karroo Basin .	This paper, pl.6(1-11).
14	Perth Basin . .	Glick.'72, pl.5(3).





Tetraporina tetragona (Pant. & Mehra'63) comb. nov.

Balmeella tetragona Pant & Mehra'63

REFERENCE POPULATION .	This paper, pl.6(12-14), 3 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1133', L.Ecca equivalent.
HOLOTYPE	Original designation, Pant & Mehra '63, pl.2(? B or C), p.116.
TYPE LOCALITY	Australia, Victoria. Surface locality, Coimadai Creek, Bacchus Marsh Tillite.
NAME DERIVATION . . .	Gr. tettares = four; Gr. gony = knee, angle; (overall shape).

DESCRIPTION (ref. pop.)

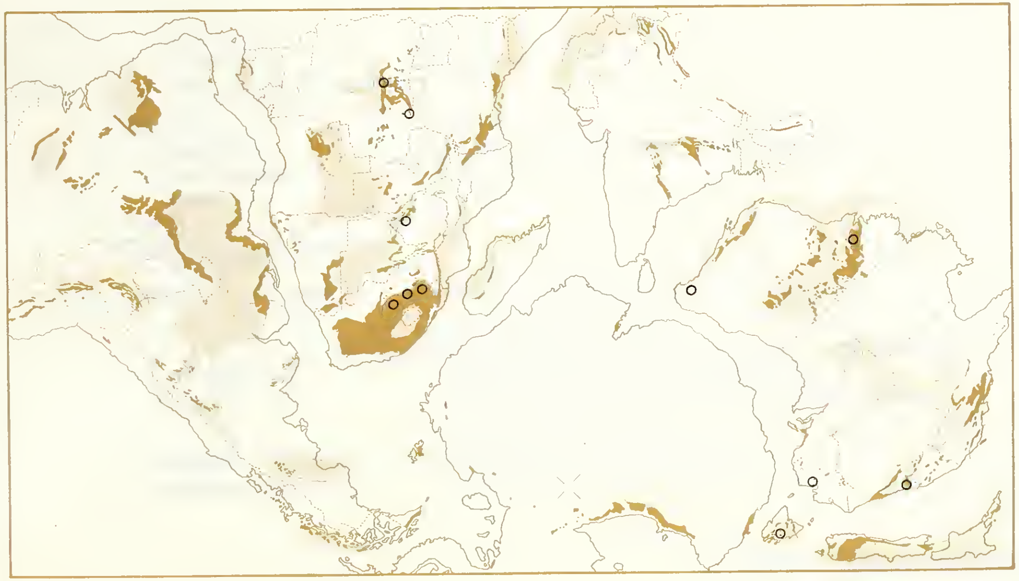
Shape	as for genus.
Exine	
Ornamentation	
Dehiscence	Porate (pores indistinct, ? diameter)
Size	54(56)58.

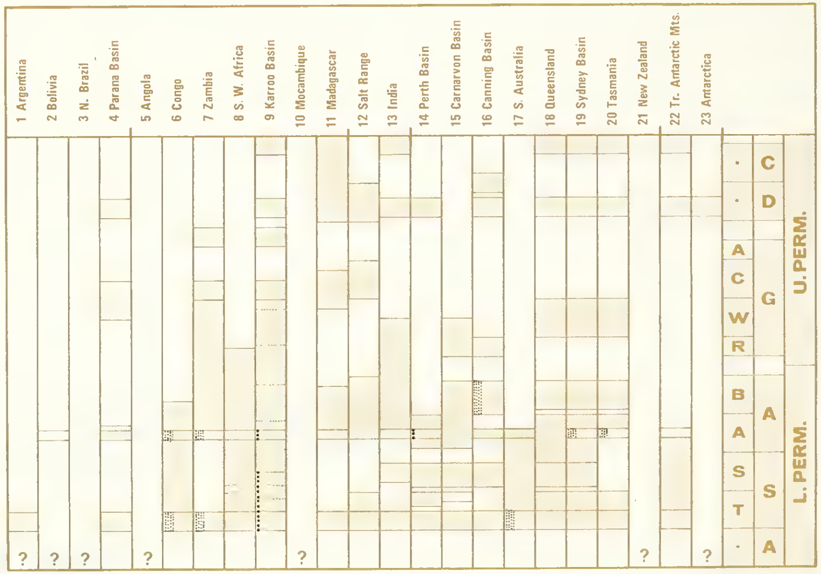
CLOSELY RELATED SPECIES

T.simplex	OO; pl.6(13) - pl.6(11).
T.superba	OO; pl.6(13) - pl.6(15).

LITERATURE

6	Congo . . .	Mahesh. & Bose'69, pl.9(11); Kar'69, pl.3(1,2).
7	Zambia . . .	Falc.'72, pl.5(19).
9	Karroo . . .	This paper, pl.6(12-14).
	Australia . . .	Balme & Henn.'56a, pl.3(66,67).
14	Perth Basin . .	Glick.'72, pl.5(1,2,4).
16	Canning Basin .	Balme'73, pl.3(19).
17	S.Australia . .	Pant. & Mehra'63, pl.2(B,C).
19	Sydney Basin .	(Balme & Henn.'56a).
20	Tasmania . .	(Balme & Henn.'56a).





Tetraporina superba Mahesh. & Bose'69

REFERENCE POPULATION .	This paper, pl.7(1-14), 14 specimens.
REFERENCE LOCALITY .	S.Africa, central Transvaal, Springbok Flats. Surface locality, HKr., M.Ecca.
HOLOTYPE	Original designation, Mahesh & Bose '69, pl.9(18), p.51.
TYPE LOCALITY	Congo, Lukuga Coalfield area, Kibamba River. Surface locality, about 2,5km. upstream from Lukuga-Kibamba confluence, ? Assise de Transition.
NAME DERIVATION . . .	L. superba = proud, superb; (general appearance).

DESCRIPTION (ref. pop.)

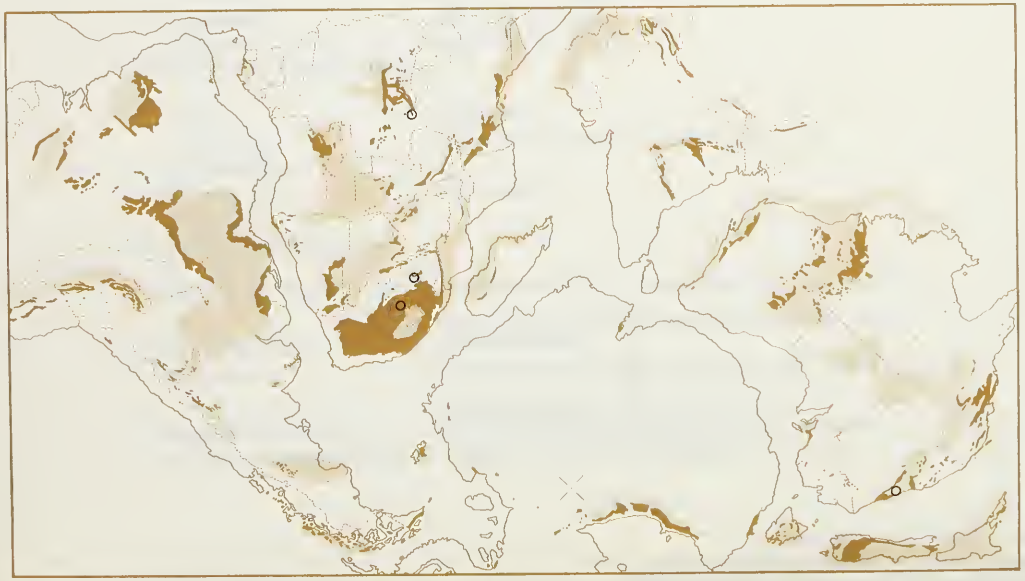
Shape	as for genus.
Exine	
Ornamentation	
Dehiscence	Porate (pores very distinct, 8(12)16mu in diameter).
Size	66(84)102.

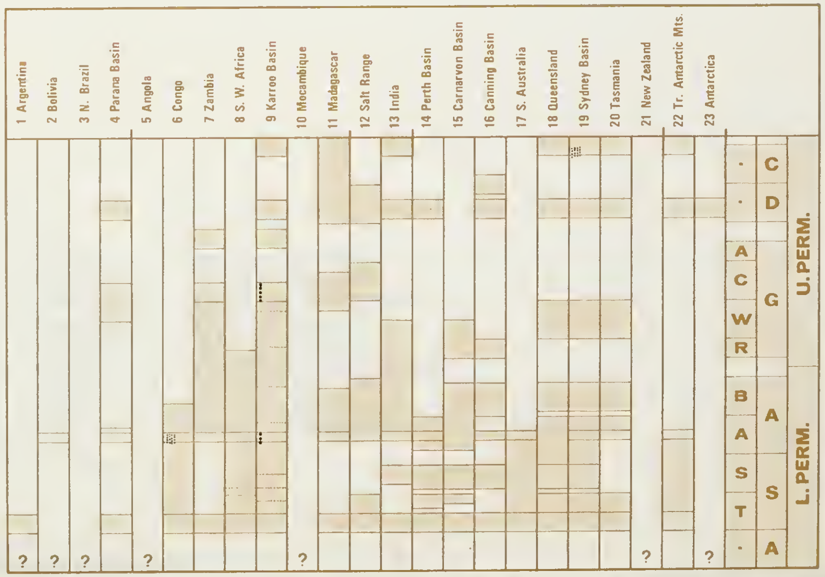
CLOSELY RELATED SPECIES

T.tetragona	OO; pl.6(15) - pl.6(13).

LITERATURE

6	Congo . . .	Mahesh. & Bose'69, pl.9(17-19).
9	Karroo Basin .	This paper, pl.6(15,16), pl.7(1-14).
19	Sydney Basin .	Helby '70, pl.43(22,23).



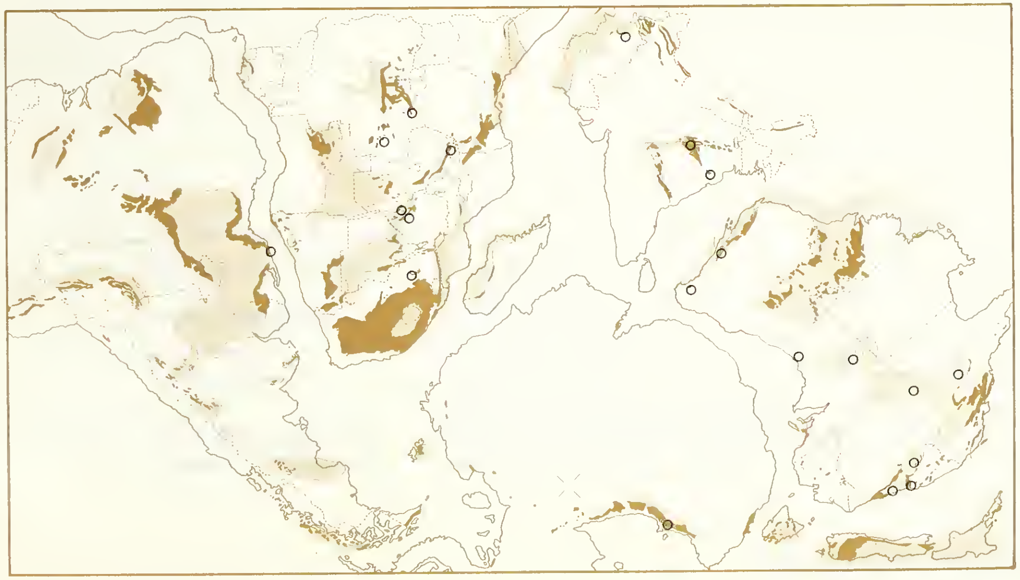


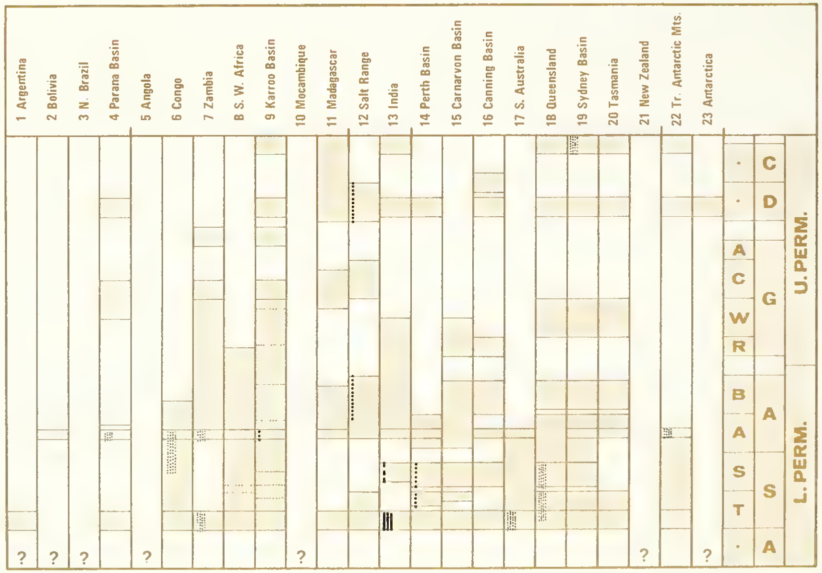
Quadrisporites horridus Henn.'58

REFERENCE POPULATION .	Pot. & Lele'61, pl.1(26-36), 11 specimens.
REFERENCE LOCALITY .	India (M.P.), S.Rewa Basin. Surface locality, Goraia, Talchir Stage.
HOLOTYPE	Designated by Hart'65; Henn.'58, pl.5(7), p.365.
TYPE LOCALITY	N.S.W., Sydney Basin. Borehole, Appin No.4, 1697'2", ? uppermost Newcastle C.M. or lowermost Narrabeen grp.
NAME DERIVATION . . .	L. horridus = horrible; (general appearance)
DESCRIPTION (ref. pop.)	as for genus.
CLOSELY RELATED SPECIES	—

LITERATURE

4	Parana Basin . .	Tiw. & Nav.'67, pl.4(73,74).
6	Congo . . .	Hoeg & Bose'60, pl.31(6); Bose & Mahesh.'68, pl.23(7); Mahesh & Bose'69, pl.9(9,10).
7	Zambia . . .	Falc.'72, pl.5(21-23); (Utt.'70).
9	Karroo Basin .	This paper, pl.8(1-3).
12	Salt Range . .	Virkki'46, pl.6(71); Balme'70, pl.22(7).
13	India	Pot. & Lele'61, pl.1(26-36); Nav. & Tiw.'66, pl.2(23,24); Bharad.'66, pl.1(10,11).
14	Perth Basin . .	Segr.'67, pl.1(8); Glick.'72, pl.1(6-8).
17	S.Australia . .	(Har. & Lud.'66; Har. & McG.'71).
18	Queensland . .	(Evans'64a,c,'66a,b,c,'67a).
19	Sydney Basin .	Henn.'58, pl.5(6,7); Helby'70, pl.43(20,21); (Evans'67b).
22	Tr.Antarctic Mts.	(Kyle'73 letter).



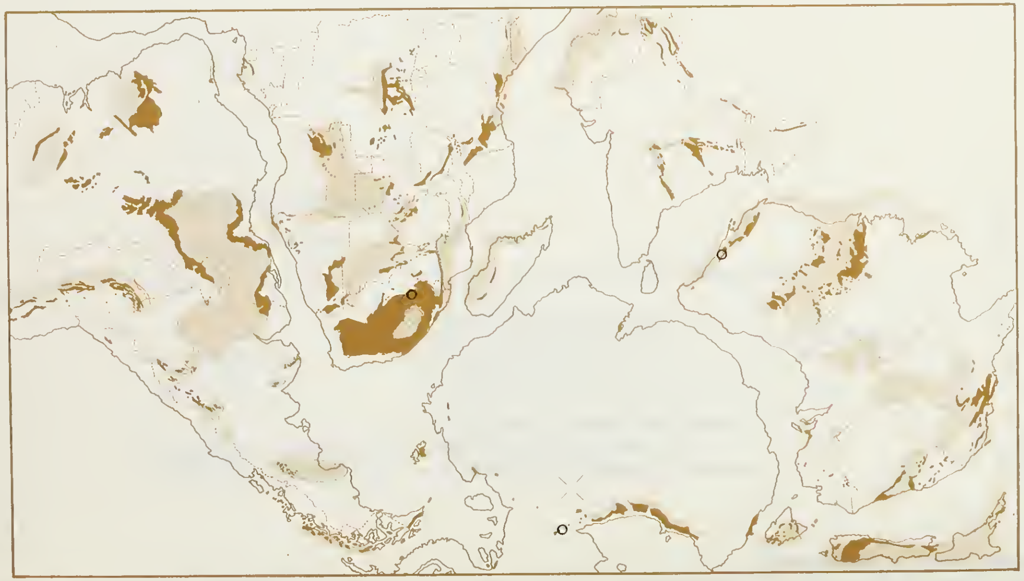


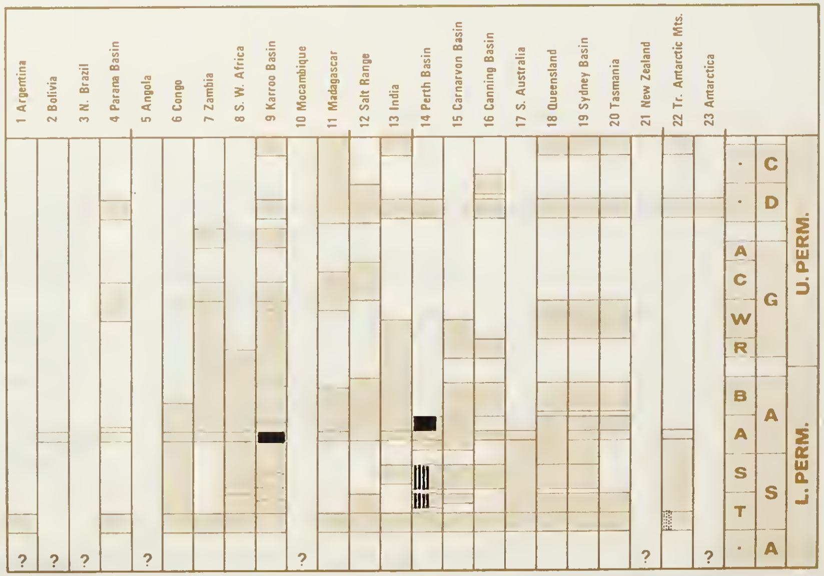
Micrhystridium karrooense sp. nov.

REFERENCE POPULATION .	This paper, pl.10(4-37), 34 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Sasolburg area. Borehole, P13, 126,50 - 128,13m., M.Ecca.
HOLOTYPE	This paper, pl.10(24).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION . . .	After Karroo Basin.
DESCRIPTION (ref. pop.) .	See notes for genus.
CLOSELY RELATED SPECIES	

LITERATURE

9	Karroo Basin .	Hart '69, pl.1(1-10), pl.2(11, 12); This paper, pl.8(4-37).
14	Perth Basin . .	Segr.'72, pl.3(8), pl.5(6).
22	Tr.Antarctic Mts.	Kemp (in press), pl.2(17,18).





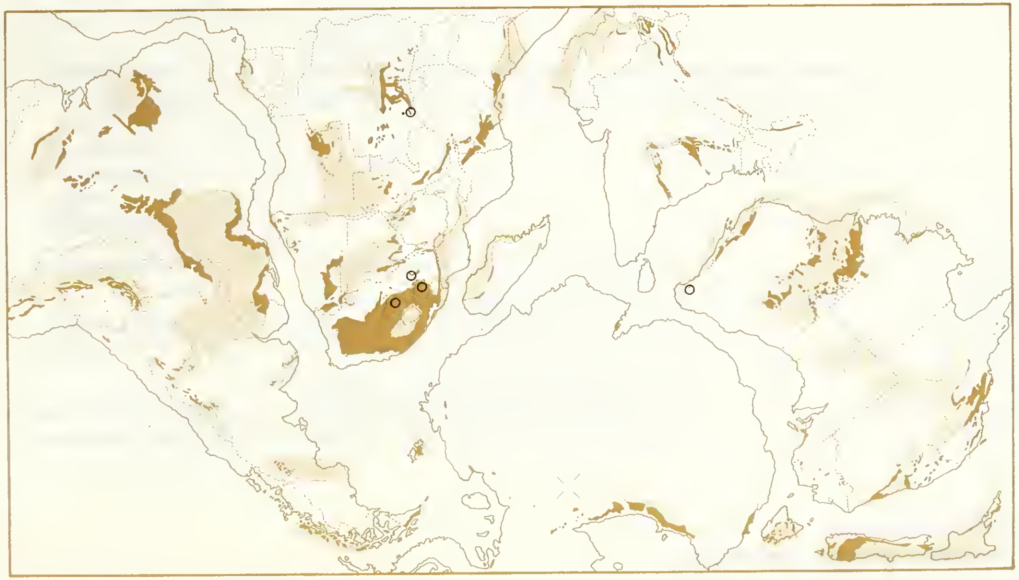
Zinjisporites congoensis (Mahesh. & Bose '69) comb. nov.

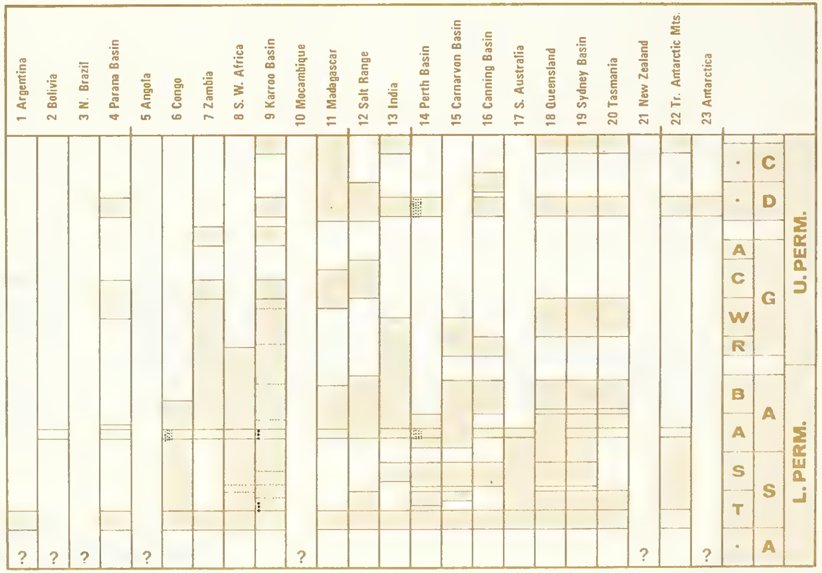
Dentatispora congoensis Mahesh. & Bose '69

REFERENCE POPULATION	This paper, pl.9(1-50), 69 specimens.
REFERENCE LOCALITY	S.Africa, central Transvaal, Springbok Flats. Surface locality, HKr., M.Ecca.
HOLOTYPE	Original designation, Mahesh. & Bose '69, pl.4(7), p.30.
TYPE LOCALITY	Congo, Lukuga Coalfield area, Kibamba River. Surface locality, about 2.5Km. upstream from Lukuga-Kibamba confluence, ? Assise de Transition.
NAME DERIVATION	After the Congo.
DESCRIPTION (ref. pop.)	
Shape	as for genus.
Contact faces	
Trilete mark	
Exine	
Equatorial region	Weakly cingulate; delicate spinose corona, 0(3)6mu broad.
Ornamentation	Relatively finely intrareticulate to rugulate, with varied development of irregular spines.
Size	32(41)50.
CLOSELY RELATED SPECIES	
Z.spinosus	ΦD; pl.9(1-9) - pl.10(1-14).

LITERATURE:

6	Congo	Mahesh. & Bose '69, pl.3(10-14,16), pl.4(2-7).
9	Karroo Basin	This paper, pl.9(1-50).
13	Perth Basin	Glick. '72, pl.13(1-5).





Zinjisporites spinosus (Kar & Bose '67) comb. nov.

Lukugasporites spinosus Kar & Bose '67

REFERENCE POPULATION .	This paper, pl.10-13 in full, 140 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Standerton area. Borehole, UC 608, 1262', Dwyka Tillite.
HOLOTYPE	Original designation, Kar & Bose'67, pl.2(12), p.24.
TYPE LOCALITY	Congo, Lukuga Coalfield area. Surface locality, sondage 10, Assise des schistes noirs de la Lukuga.
NAME DERIVATION . . .	L. spinosus = thorny, spiny; (ornamentation).

DESCRIPTION (ref. pop.)

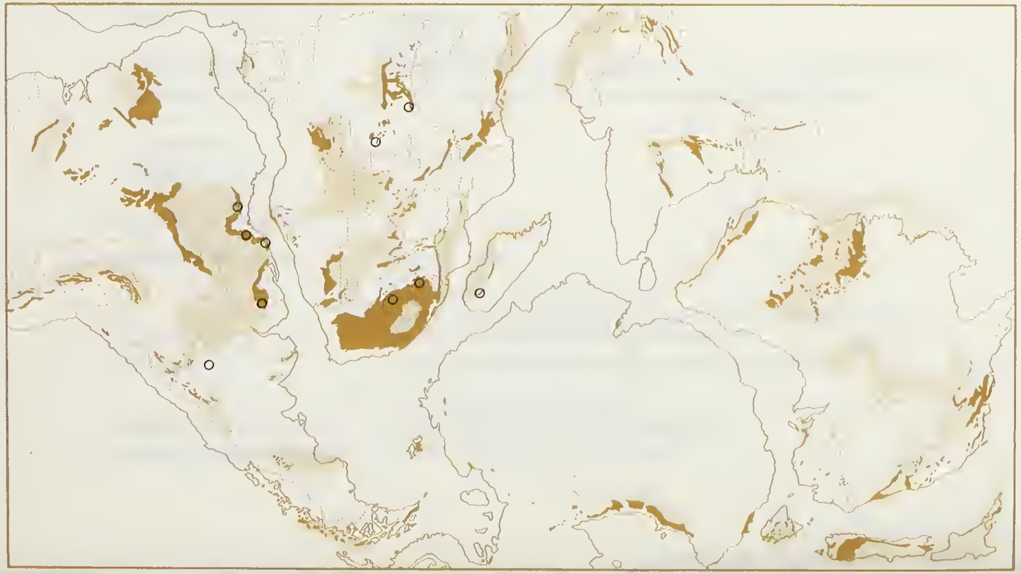
Shape	as for genus.
Contact faces	as for genus.
Trilete mark	as for genus.
Exine	as for genus.
Equatorial region . . .	Weakly cingulate; heavy spinose corona, 0(7) 14mu broad.
Ornamentation	Relatively coarsely intrareticulate to rugulate, with varied development of irregular spines.
Size	36(71) 106.

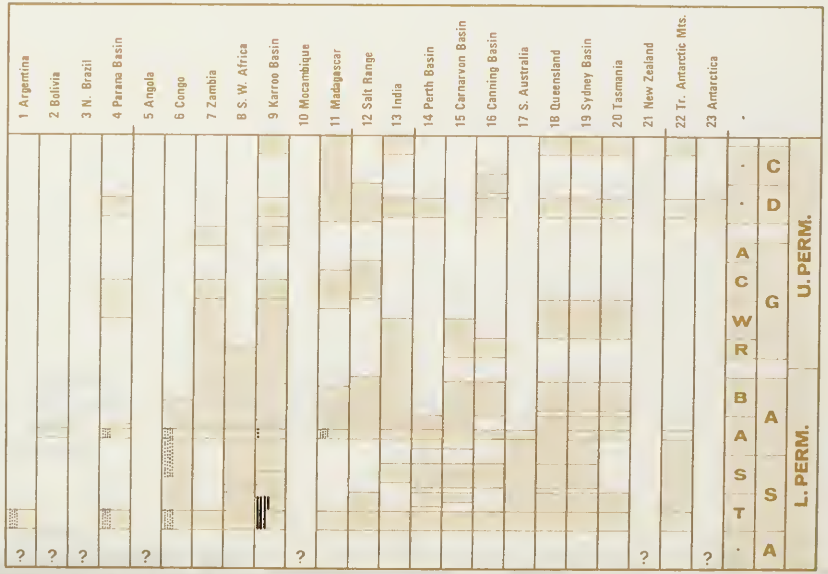
CLOSELY RELATED SPECIES

Z.congoensis . . . . . OD; pl.10(1-14) - pl.9(1-9).

LITERATURE:

1	Argentina . .	Menend.'69, pl.2(2-5,8-10); Menend.'71, pl.1(6-9), pl.2(1-7), pl.3(1-6).
4	Parana Basin .	Tiw. & Nav.'67, pl.2(23-25); Bharad.'69, pl.1(24-26); Kemp (in press), pl.3(17).
6	Congo . . .	Kar & Bose'67, pl.2(12,13), pl.3(6-9); Bose & Mahesh.'68, pl.4(16,17); Mahesh.'69, pl.1(18,19), pl.2(1,4-16), pl.3(1-5).
7	Zambia . . .	Hart'63b, pl.1(11,12,17); Falcon'72, pl.4(11-14).
9	Karroo Basin .	This paper, pl.10-13 in full.
11	Madagascar . .	Rakoto.'70, pl.8(1-9), pl.9(1,2,7-9).





Gondisporites punctatus (Hart '63) comb. nov.

Grandispora punctata Hart '63

REFERENCE POPULATION .	This paper, pl.14(42-63), 28 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1151'3" to 1152'9", L.Ecca equivalent.
HOLOTYPE	Original designation, Hart '63, pl.1(1), p.140.
TYPE LOCALITY	S.Africa, northern Karroo Basin, Viljoenskroon area. Salisbury borehole, assemblage no.204, 364', L. Ecca equivalent.
NAME DERIVATION . . .	L. punctatus = punctate; (incorrectly applied to ornamentation).

DESCRIPTION (ref. pop.)

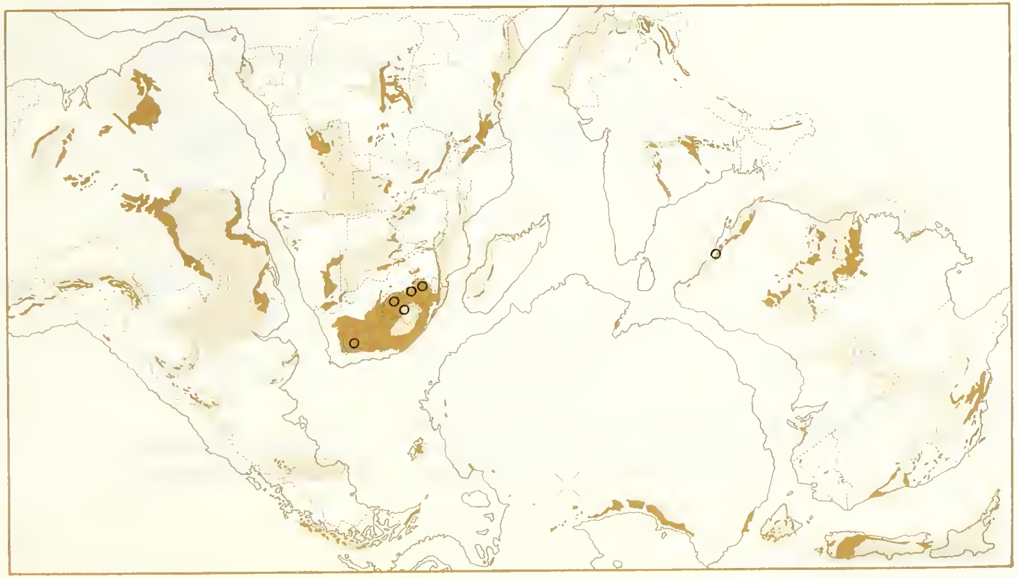
Shape	as for genus.
Contact faces	
Trilete mark	
Exine	
Equatorial region . . .	Weakly cingulate; finely granulate/spinate margin, or very narrow spinate corona.
Ornamentation	Finely granulate/spinate.
Size	44(62)80.

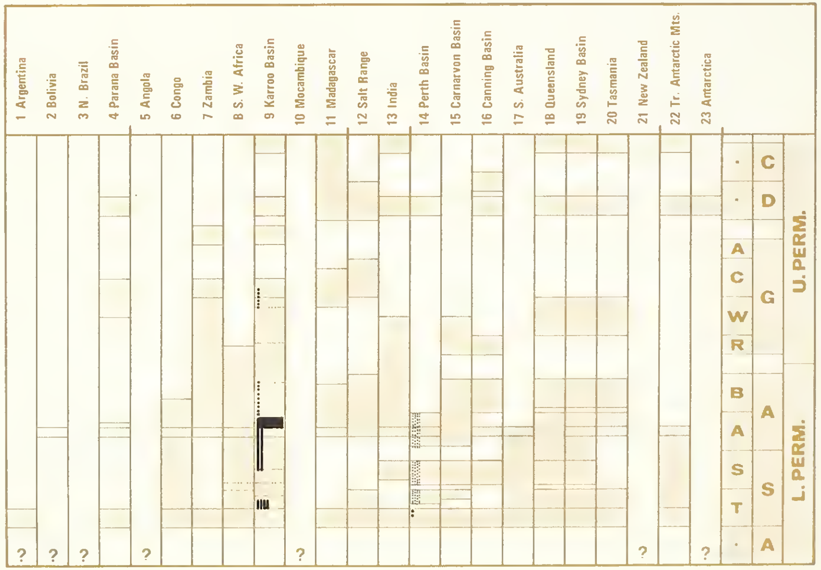
CLOSELY RELATED SPECIES

G.parvus	Φ ; pl.14(42-63) - pl.14(1-41).
G.raniganjensis	ΦΦ; pl.14(62) - pl.17(1).

LITERATURE:

9	Karroo Basin .	Hart '63a, pl.1(1,2,14); This paper, pl.14(42-63), pl.15(1-18).
14	Perth Basin . .	Segr.'70, pl.8(D-E), pl.2(10).





Gondisporites parvus sp. nov.

REFERENCE POPULATION	This paper, pl.14(1-41), 50 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP6, 1151'3" to 1152'9", L.Ecca equivalent.
HOLOTYPE	This paper, pl.14(26).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION	L. parvus = small; (overall size).

DESCRIPTION (ref. pop.)

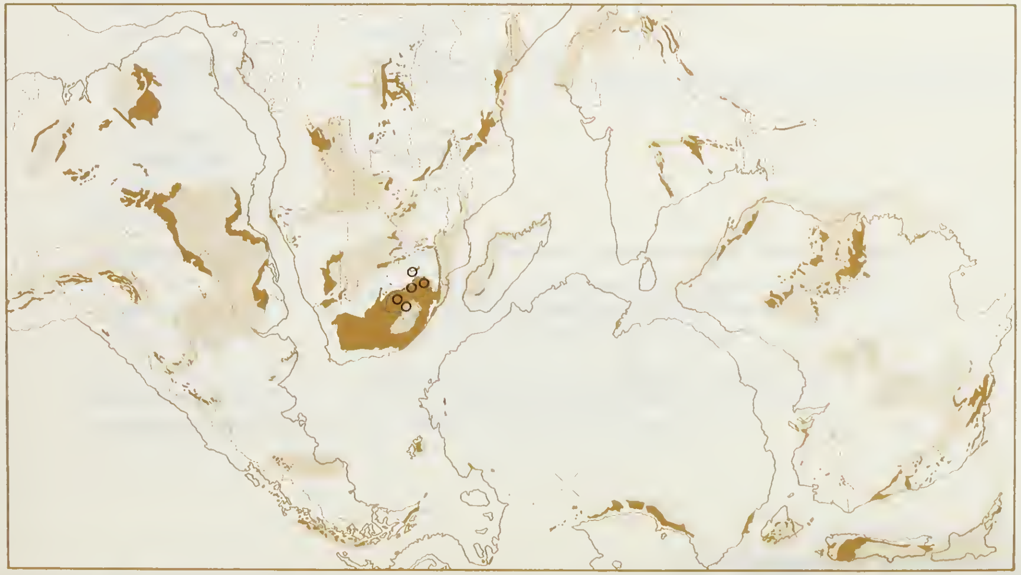
Shape **Contact faces** **Trilete mark** **Exine**	as for genus.
Equatorial region	Weakly cingulate; finely granulate/spinate to papillate margin.
Ornamentation	Finely granulate/spinate to papillate.
Size	24(32)40.

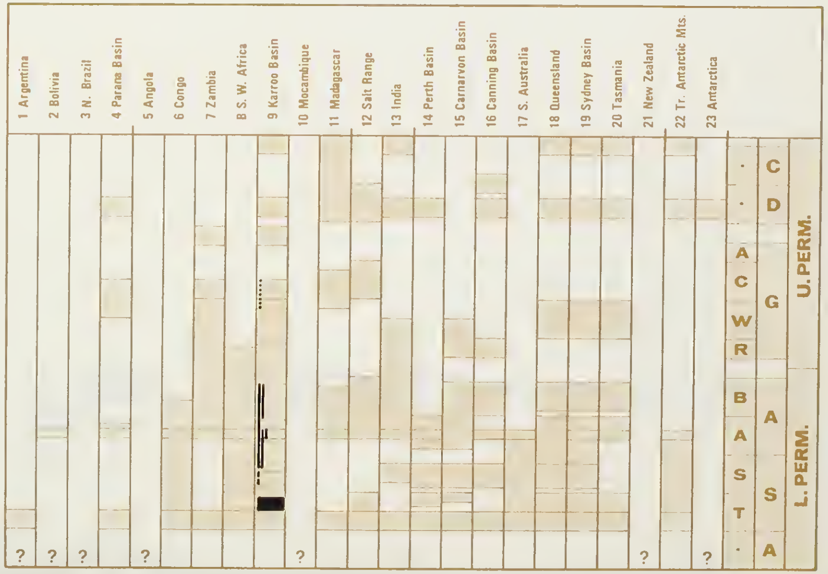
CLOSELY RELATED SPECIES

G.punctatus	Φ ; pl.14(1-41) - pl.14(42-63).
G.echinatus	Φ ; pl.16(1-49) - pl.16(50-64).

LITERATURE:

9	Karroo Basin	Hart '63a, pl.1(3,6-8); This paper, pl.14(1-41), pl.16(1-49).





Gondisporites echinatus sp. nov.

REFERENCE POPULATION .	This paper, pl.16(50-64), 26 specimens.
REFERENCE LOCALITY .	S.Africa, central Transvaal, Springbok Flats. Surface locality, HKr, M.Ecca.
HOLOTYPE	This paper, pl.16(51).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION . . .	Gr. echinos = urchin, hedgehog; (ornamentation).

DESCRIPTION (ref. pop.)

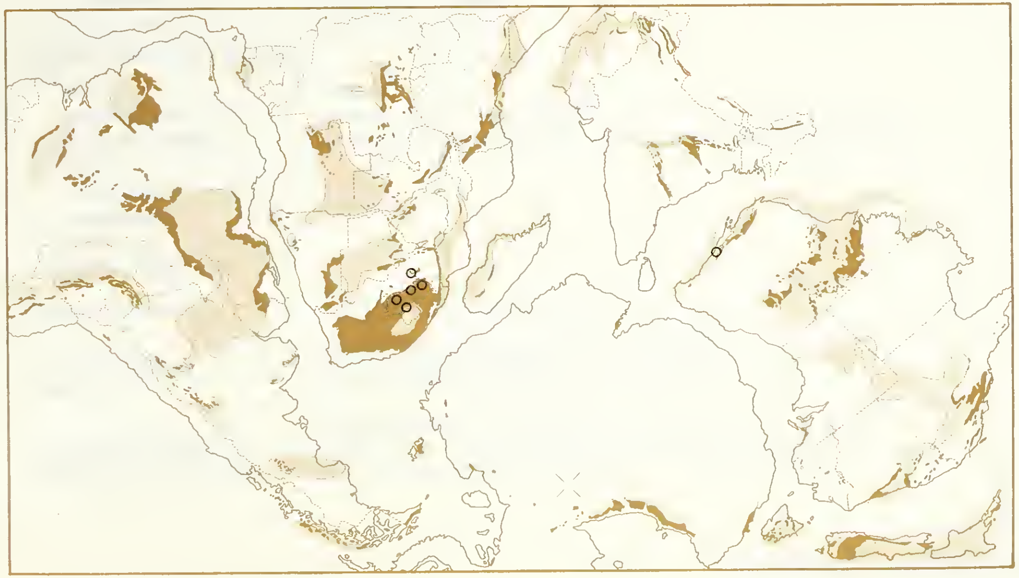
Shape . . . . **Contact faces** . . . . **Trilete mark** . . . . . **Exine**	as for genus.
Equatorial region . . .	Weakly cingulate; spinate/echinate margin.
Ornamentation	Spinate/echinate.
Size	44 (50) 56.

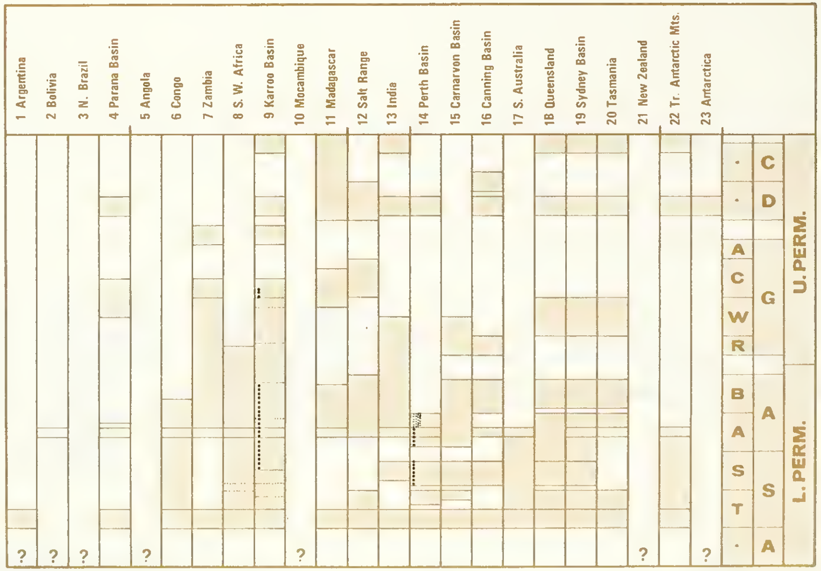
CLOSELY RELATED SPECIES

G.parvus	⦶ ; pl.16(50-64) - pl.16(1-49).
G.raniganjensis	⦶⦶; pl.16(62) - pl.17(6).

LITERATURE:

9	Karroo Basin .	This paper, pl.16(50-64).
14	Perth Basin . .	Segr.'70, pl.8(H-I); Segr.'72, pl.5(4).





Gondisporites raniganjensis Bharad.'62

REFERENCE POPULATION .	This paper, pl.17(1-32), 32 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Greylingstad/Bethal/Hendrina area. Borehole, UC 621, 153', M.Ecca.
HOLOTYPE	Original designation, Bharad. '62, pl.2(48), p.82.
TYPE LOCALITY	India, East Raniganj Coalfield. Samla-Kendra Colliery, Samla seam, Raniganj Stage.
NAME DERIVATION . . .	After the Raniganj Coalfield, India.

DESCRIPTION (ref. pop.)

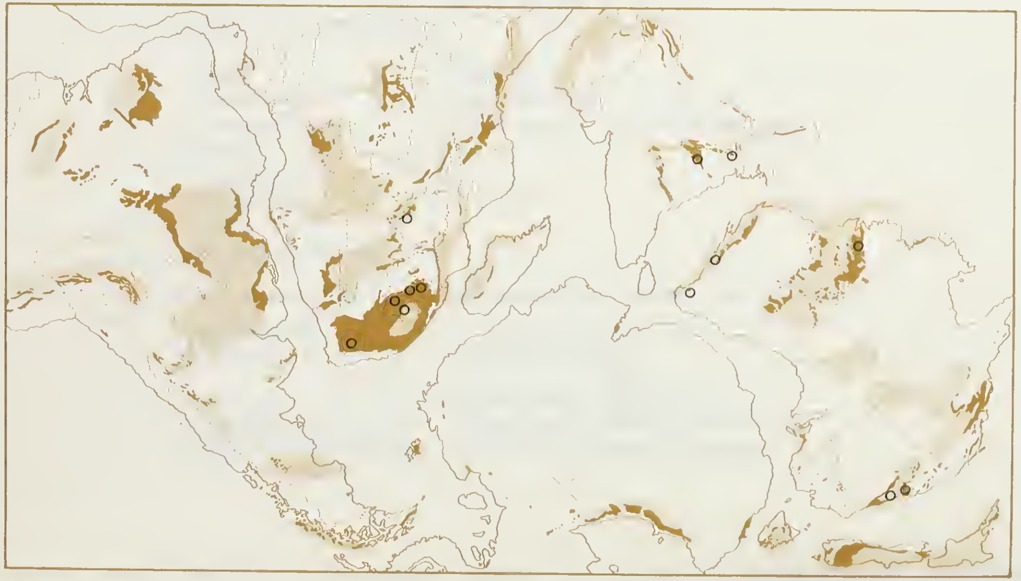
Shape	as for genus.
Contact faces	
Trilete mark	
Exine	
Equatorial region . . .	Weakly cingulate; spinose margin, narrow spinose corona or narrow zona.
Ornamentation	Finely to coarsely spinate/echinate.
Size	56 (76) 96.

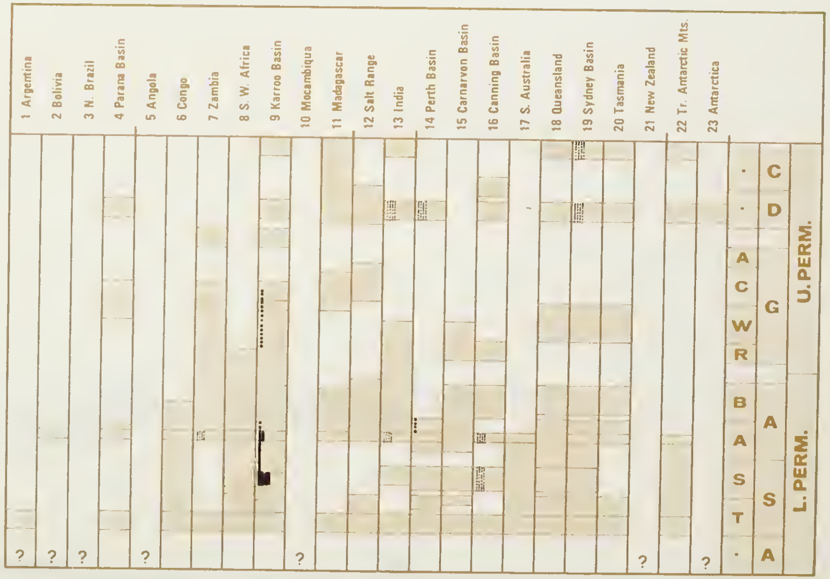
CLOSELY RELATED SPECIES

G.punctatus	OD; pl.17(1) - pl.14(62).
G.echinatus	OD; pl.17(6) - pl.16(62).
G.braziliensis	OD; pl.22(2) - pl.23(22).
G.splendens	OD; pl.18(20) - pl.34(31).

LITERATURE:

7	Zambia . . .	Falc.'72, pl.4(20-22).
9	Karroo Basin .	This paper, pl.17-22 in full.
13	India	Bharad.'62, pl.4(66-71); Tiw.'64, pl.1(1,2); Bharad. & Tiw.'64b, pl.1(10); Bharad.'66, pl.3(34).
14	Perth Basin .	Segr.'70, pl.8(A-C); Segr.'72, pl.6(3); Glick.'72, pl.16(1-8), pl.17(1-6).
16	Canning Basin .	Balme'73, pl.5(10), pl.7(6).
19	Sydney Basin .	Helby'70, pl.19(1-7).





Gondisporites braziliensis (Pant. & Sriv.'65) comb. nov.

Densosporites braziliensis Pant & Sriv.'65

REFERENCE POPULATION .	This paper, pl.23(1-27), 33 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Greylingstad/Bethal/Hendrina area. Borehole, UC 621, 153', M.Ecca.
HOLOTYPE	Original designation, Pant & Sriv.'65, pl.1(1), p.469.
TYPE LOCALITY	Brazil, Parana Basin, ? locality.
NAME DERIVATION . . .	After Brazil, S.America.

DESCRIPTION (ref. pop.)

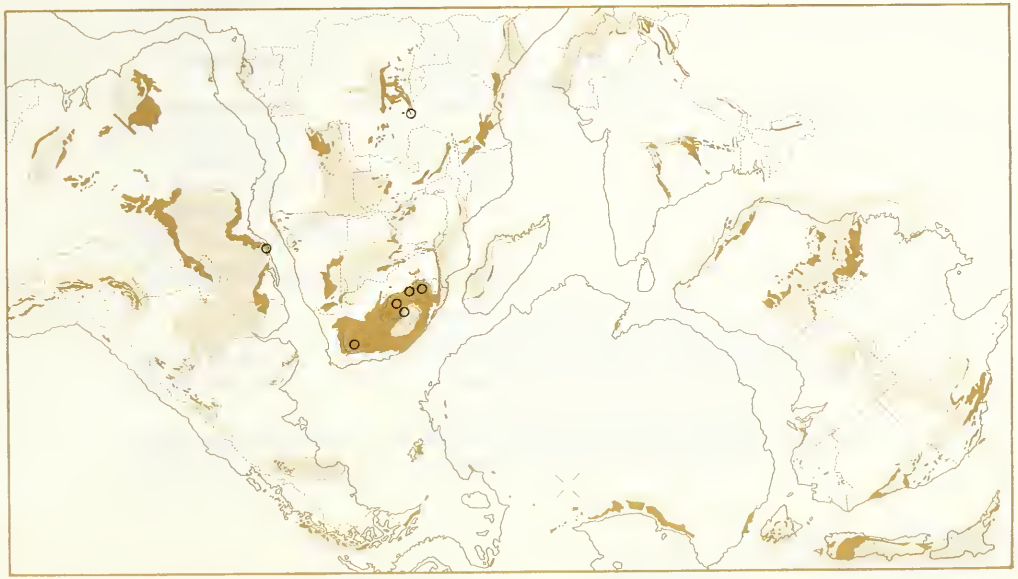
Shape	as for genus.
Contact faces	
Trilete mark	
Exine	
Equatorial Region . . .	Strongly cingulate; spongeous margin.
Ornamentation	Spongeous
Size	64(82) 100.

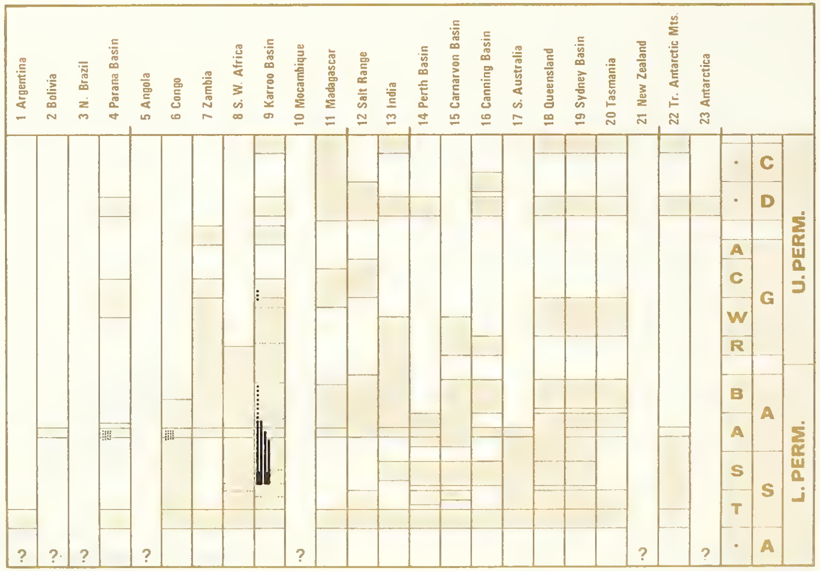
CLOSELY RELATED SPECIES

G.raniganjensis	CD; pl.23(22) - pl.22(2).
G.lacunata	CD; pl.23(14) - pl.25(28).

LITERATURE:

4	Parana Basin . .	Pant & Sriv.'65, pl.1(1-5); Tiw. & Nav.'67, pl.1(13-15), pl.2(18-20).
6	Congo . . .	Mahesh. & Bose'69, pl.3(21).
9	Karroo Basin .	This paper, pl.23-24 in full.





Gondisporites congoensis (Mahesh. & Bose '69) comb. nov.

Densosporites congoensis Mahesh. & Bose '69

REFERENCE POPULATION	This paper, pl.25(1-27), 27 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP6, 1133', L.Ecca equivalent.
HOLOTYPE	Original designation, Mahesh. & Bose '69, pl.3(18), p.27.
TYPE LOCALITY	Congo, Lukuga Coalfield area, Kibamba River. Surface locality, about 2.5km. upstream from Lukuga-Kibamba confluence, ? Assise de Transition.
NAME DERIVATION	After Congo.

DESCRIPTION (ref. pop.)

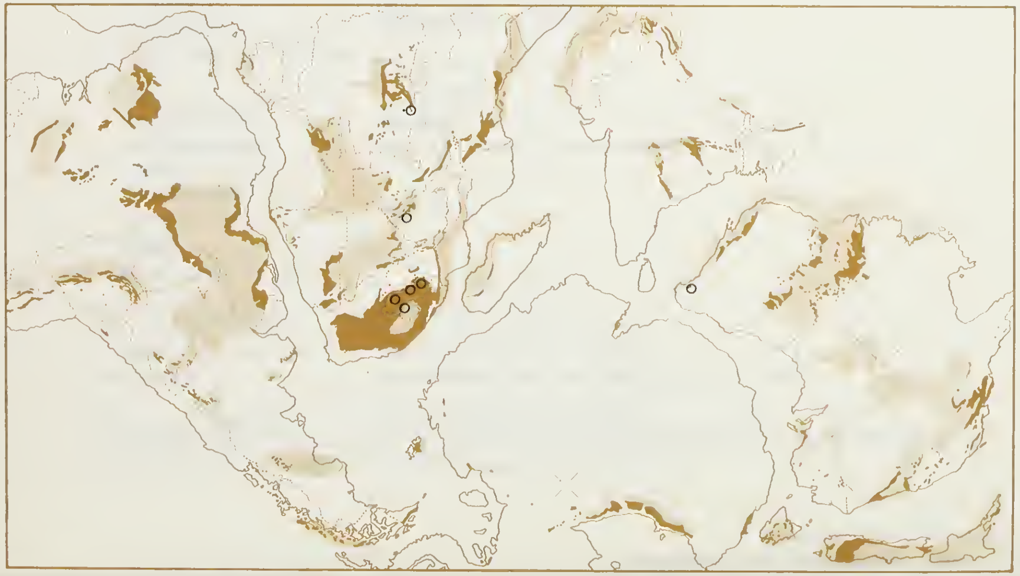
Shape	as for genus.
Contact faces	
Trilete mark	
Exine	
Equatorial region	Strongly cingulate; cingulum ± evenly broad (±4mu) throughout; spongeous margin.
Ornamentation	Spongeous to verrucate.
Size	34(42)50.

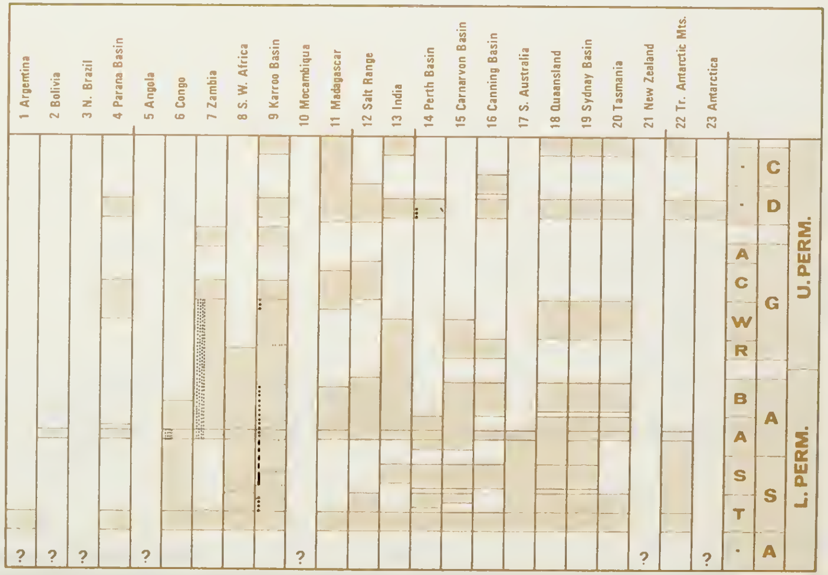
CLOSELY RELATED SPECIES

G.lacunatus	OO; pl.25(25) - pl.25(30).
G.variabilis	ꝏ : pl.25(12) - pl.26(1).

LITERATURE:

6	Congo	Mahesh. & Bose '69, pl.3(17-20).
7	Zambia	Falc.'72, pl.4(17,18).
9	Karroo Basin	This paper, pl.25(1-27).
14	Perth Basin	Glick.'72, pl.14(12-14).





Gondisporites lacunatus (Tiw.'65) comb. nov.

Dentatispora lacunata Tiw.'65

REFERENCE POPULATION	This paper, pl.25(28-32), 14 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Greylingstad/Bethal/Hendrina area. Borehole, UC 621, 153', M.Ecca.
HOLOTYPE	Original designation, Tiw.'65, pl.2(50), p.178.
TYPE LOCALITY	India (M.P.), Korba Coalfield, 763(c).
NAME DERIVATION	L. lacuna = gap, (ornamentation).

DESCRIPTION (ref. pop.)

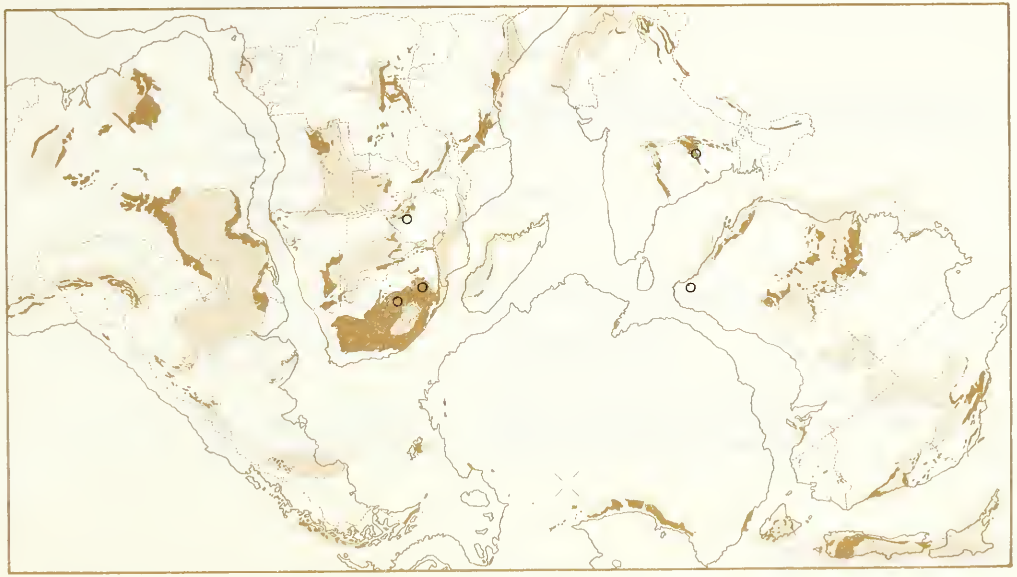
Shape **Contact faces** **Trilete mark** **Exine**	as for genus.
Equatorial region	Strongly cingulate; irregular margin.
Ornamentation	Verrucate/intrareticulate.
Size	46 (56) 66.

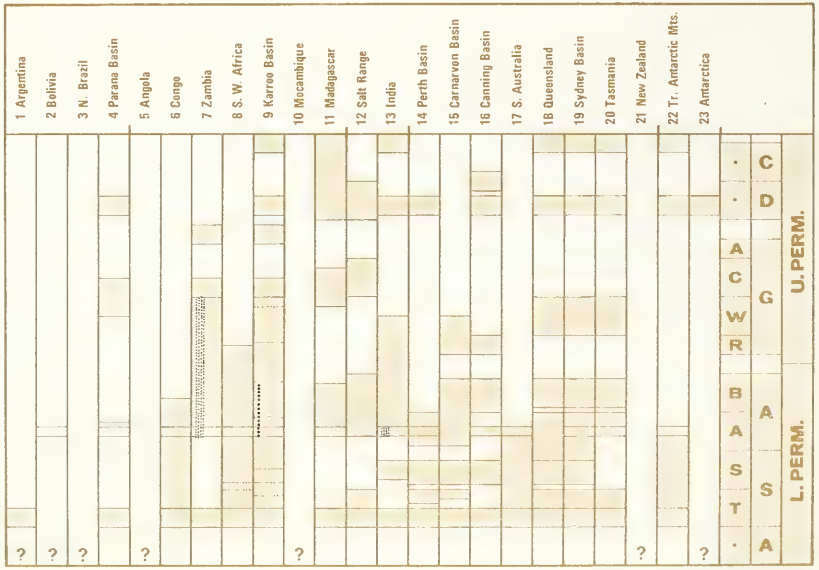
CLOSELY RELATED SPECIES

G.braziliensis	⊕ ; pl.25(28) - pl.23(14).
G.congoensis	OO; pl.25(30) - pl.25(25).

LITERATURE:

7	Zambia	Falc.'72, pl.4(19).
9	Karroo Basin	This paper, pl.25(28-35).
13	India	Tiw.'64, pl.1(3); Tiw.'65, pl.2(50,51); Bharad.'66, pl.3(33).
14	Perth Basin	Glick.'72, pl.14(15-17).





Gondisporites regularis sp. nov.

REFERENCE POPULATION .	This paper, pl.25(36-42), 13 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1151'3" to 1152'9", L.Ecca equivalent.
HOLOTYPE	This paper, pl.25(38).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION . . .	L. regularis = regular, (general appearance).

DESCRIPTION (ref. pop.)

Shape	as for genus.
Contact faces	
Trilete mark	
Exine	
Equatorial region . . .	Strongly cingulate, cingulum broadest (±6mu) towards centre of interradial area and narrowest (±4mu) towards radial area; spongeous margin.
Ornamentation	Spongeous.
Size	38(44)50.

CLOSELY RELATED SPECIES

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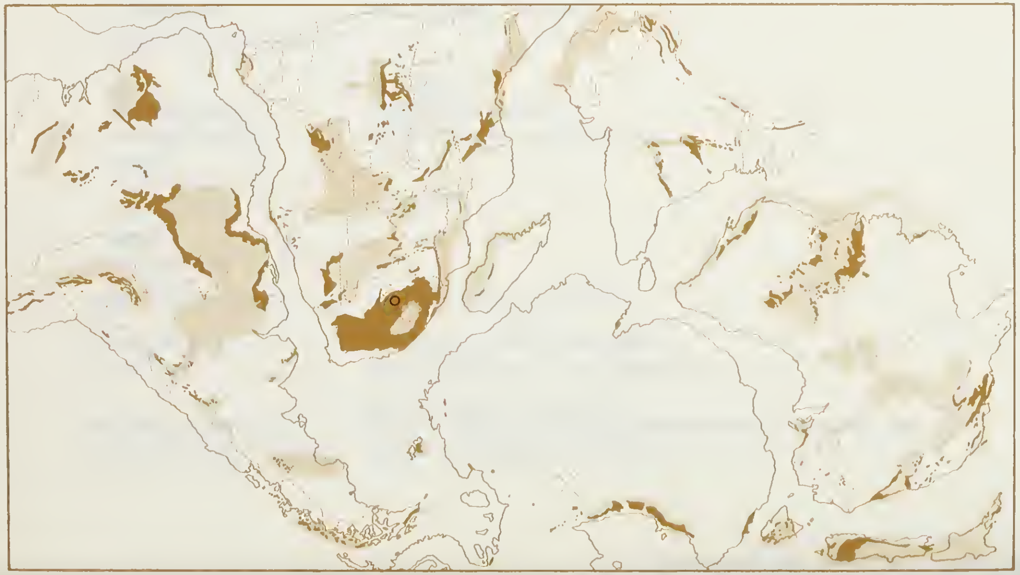
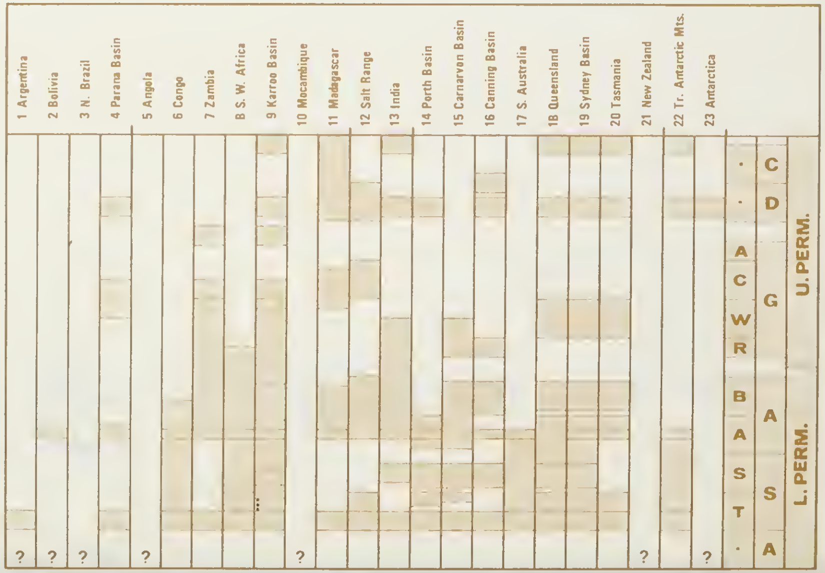
LITERATURE:

9	Karroo Basin .	This paper, pl.25(36-42).





Gondisporites variabilis sp. nov.

REFERENCE POPULATION	This paper, pl.26-28 in full, 152 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Greylingstad/Bethal/Hendrina area. Borehole, WV3, 133,50m., M.Ecca.
HOLOTYPE	This paper, pl.27(25).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION	L.variabilis = variable, (variable nature of species).

DESCRIPTION (ref. pop.)

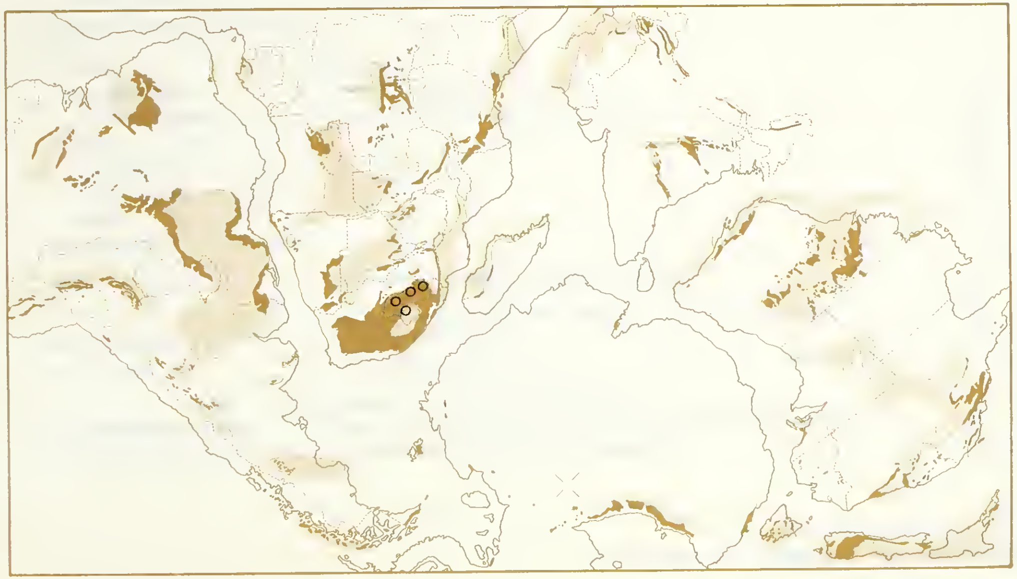
Shape	as for genus.
Contact faces	
Trilete mark	
Exine	
Equatorial region	Strongly cingulate; with or without the development of a narrow spinose corona or zona.
Ornamentation	Spongeous to spinate/echinate.
Size	36 (56) 76.

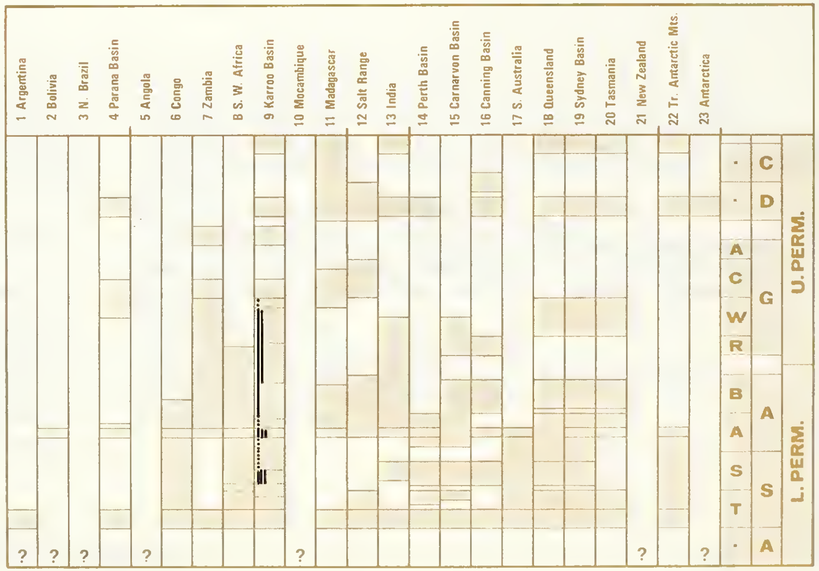
CLOSELY RELATED SPECIES

G.congoensis	OD; pl.26(1) - pl.25(12).
G.splendens	O ; pl.26-28(in full) - pl.29-32(in full).

LITERATURE

9	Karroo Basin	This paper, pl.26-28 in full.





Gondisporites splendens (Balme & Henn.'56) comb. nov.

Cirratriradites splendens Balme & Henn.'56

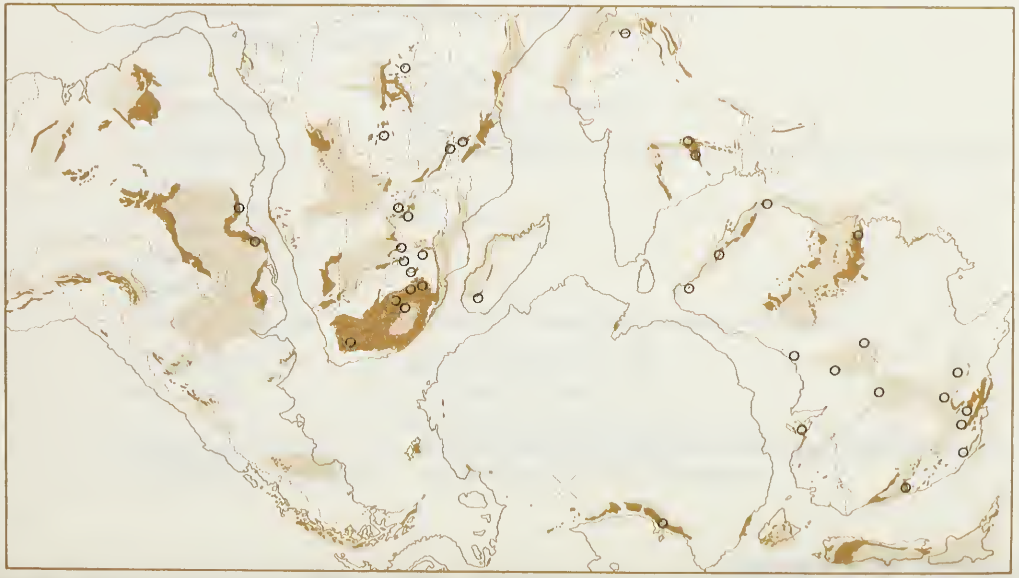
REFERENCE POPULATION	This paper, pl.29-32 in full, 117 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Greylingstad/Bethal/Hendrina area. Borehole, WV3, 133,50 m., M.Ecca.
HOLOTYPE	Not designated to date.
TYPE LOCALITY	N.S.W., Sydney Basin. Hebburn No.2 Colliery, Main Greta seam, Greta Coal Measures.
NAME DERIVATION	L.splendens = splendid, (general appearance).
DESCRIPTION (ref. pop.)	
Shape	as for genus.
Contact faces	as for genus.
Trilete mark	as for genus.
Exine	as for genus.
Equatorial region	Cingulate; spinose corona to broad zona.
Ornamentation	Spongeous to spinate/echinate.
Size	44 (60) 76.

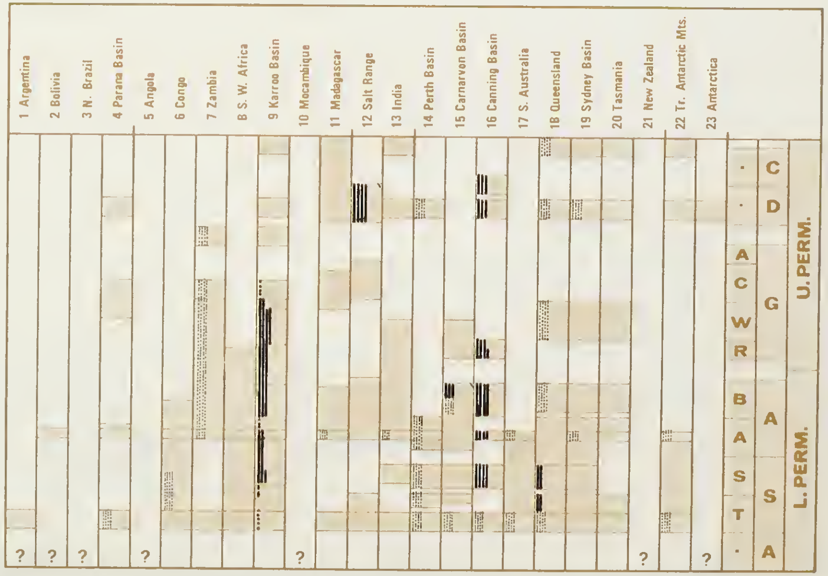
CLOSELY RELATED SPECIES

G.raniganjensis	⦶⦶; pl.34(31) - pl.18(20).
G.variabilis	⦶ ; pl.29-32 (in full) - pl.26-28 (in full).

LITERATURE:

4	Parana Basin	Kemp (in press), pl.1(20).
6	Congo	Pier.'59, pl.9(5); Bose & Kar'66, pl.19(16).
7	Zambia	Hart'60, pl.1(17); Hart'63b, pl.1(8); Falc.'72, pl.4(1-10); (Utt.'70).
9	Karroo Basin	Hart'63a, pl.1(5); This paper, pl.29-36 in full.
11	Madagascar	Rakoto.'70, pl.10(1,3-9).
12	Salt Range	Balme'70, pl.4(9-17).
13	India	Tiw.'64, pl.1(4-6); Bharad. & Tiw.'64b, pl.1(7); Tiw.'65, pl.3(55,56,59,60); Bharad.'66, pl.3(32); Bharad & Sinha'69b, pl.1(1-9); Sinha'72, pl.1(25-28).
	Australia	Balme'64, pl.3(6), pl.4(13,16); Balme & Henn.'56b, pl.5(57-59), pl.6(60-61).
14	Perth Basin	Segr.'70, pl.8(G), pl.9(A-I); Segr.'72, pl.5(5), pl.6(7); Glick.'72, pl.18(1-6), pl.19(1-6), pl.20(7-11).
15	Carnarvon Basin	(Balme'67).
16	Canning Basin	Balme'73, pl.2(18,20), pl.3(8), pl.4(9), pl.5(7,14,15,17), pl.7(11,12); (Balme'68).
17	S.Australia	(Balme'57; Evans'64b; Har. & Lud.'66; Har. & McG.'71).
18	Queensland	(Evans'64a,c,'66a,b,c,'67a; Pat.'65; deJers.'70,'73; Norv.'71; Rig.'73).
19	Sydney Basin	(Evans'67a,b; Helby'70).
22	Tr. Antarctic Mts.	(Barr. & Kyle (in press); Kyle ('73 letter)).



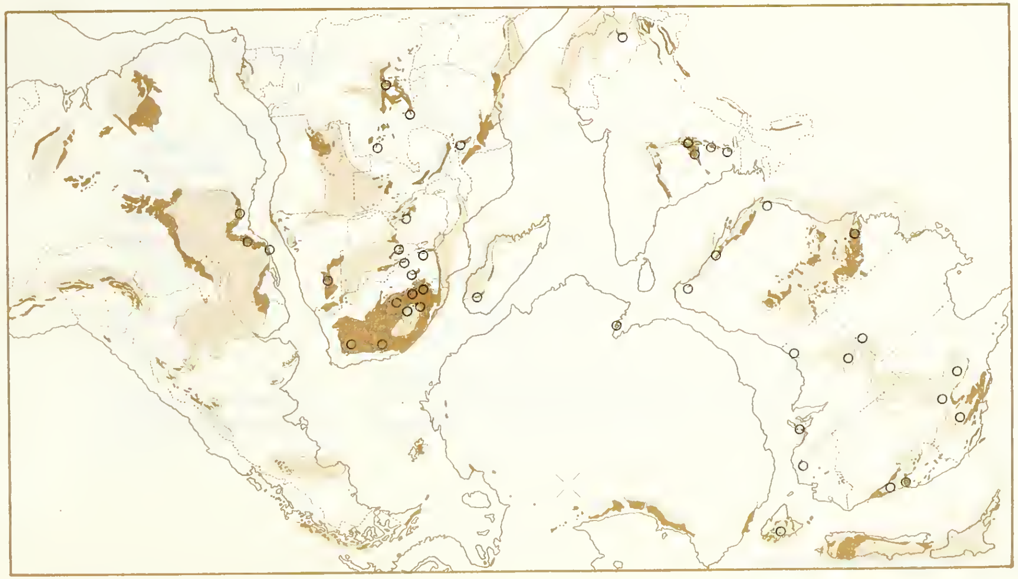


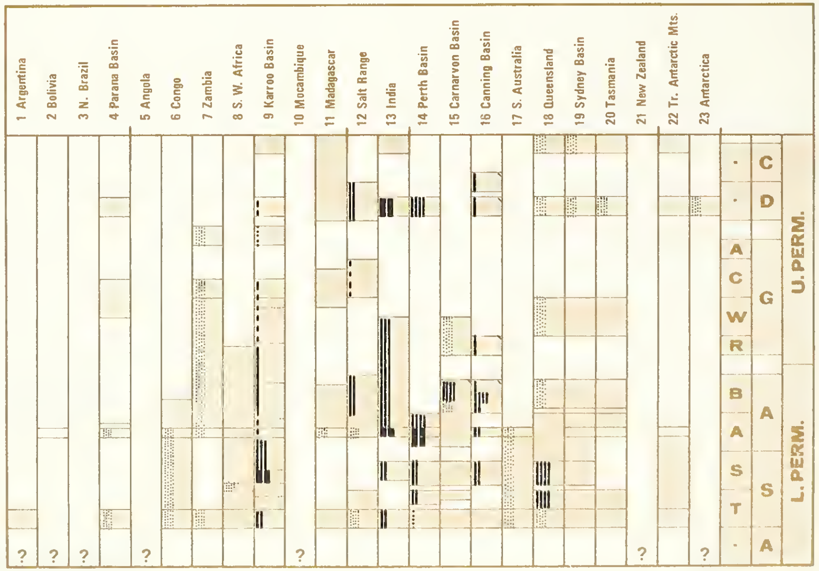
Acanthotriletes spp.

See write-up under genus.

LITERATURE

4	Parana Basin . .	Tiw. & Nav.'67, pl.1(4,8); Kemp (in press), pl.1(3,4).
6	Congo . . .	Bose & Kar'66, pl.14(1,2,7,8), pl.30(16,17); Kar & Bose'67, pl.1(3,4,21-24,26-28); Mahesh. & Bose'69; pl.1(6-8), pl.2(8,13,17); Mahesh.'69, pl.1(7-12).
7	Zambia . . .	Hart'60, pl.3(39); Hart'63b, pl.1(18); Falc.'72, pl.1(16-19), pl.3(10-19).
8	S.W.Africa . .	Lesch.'59, pl.1(1).
9	Karroo Basin .	Ril.'54, pl.5(I); Hart'63a, pl.1(13); This paper, pl.37-43 in full; (Hart'66b).
11	Madagascar . .	Rakoto.'70, pl.5(5,19), pl.6(5-14).
12	Salt Range . .	Venk. & Kar'68b, pl.1(9); Balme'70, pl.1(1-9); Kemp (in press), pl.2(3,4).
13	India	Bharad.'62, pl.1(1-3,18-28,31,32); Bharad. & Sal.'64, pl.1(1-5), pl.2(26-40,44); Bharad. & Tiw.'64b, pl.1(3,5,12); Bharad. & Sal.'65a, pl.1(11,12,14,15,17,18); Tiw.'65, pl.1(13-16,21-27); Bharad, Sah & Tiw.'65, pl.1(1,2); Maithy'65, pl.1(1); Bharad.'66, pl.3(25,26), pl.5(46); Kar'66, pl.1(3,7); Mahesh.'67, pl.1(3,8,9,10,11); Nav. & Tiw.'67, pl.8(4,5); Nav. & Tiw.'68, pl.1(4,5); Venk. & Kar'68a, pl.1(6,7,13-19,25-27); Kar'68a, pl.1(3,11-14,16-18); Tiw.'68, pl.1(17-19); Kar.'68c, pl.1(1,2); Lele & Karim'71, pl.1(3); Tiw.& Moiz.'71, pl.1(9-18); Sinha'72, pl.1(1,2,7-12); Anand.'72, pl.1(1-3).
	Australia . . .	Balme & Henn.'56b, pl.2(27-29), pl.3(39-41); Balme'64, pl.3(5).
14	Perth Basin . .	Segr.'70, pl.2(H), pl.3(H.I), pl.4(E,F); Segr.'72, pl.4(7), pl.5(2); Glick.'72, pl.8(19), pl.9(1-3), pl.10(5-7).
15	Carnarvon Basin .	(Balme'67).
16	Canning Basin .	Balme'73, pl.2(3,4,6,7), pl.3(2), pl.4(2,5), pl.5(4), pl.7(3,8); (Balme'68).
17	S.Australia . .	Evans'64b, pl.1(9-11); (Har. & Lud.'66; Har. & McG.'68,'71; Doug.'69)
18	Queensland . .	deJers.'70, pl.1(6-8); (Evans'64a,c,'66a,b,c,'67a; Burg.'70; Norv.'71; Rig.'73).
19	Sydney Basin .	Helby'70, pl.1(2-5), pl.4(2,3,12,13,16,17), pl.5(3,4,7,10,11), pl.8(1-19), pl.9(1); (Balme & Henn.'56b; Evans'67b).
20	Tasmania . .	(Balme & Henn.'56b; Banks & Naqvi'67).
23	Antarctica . .	Balme & Playf.'67, pl.1(4).





Microbaculispora labyrinthica sp. nov.

REFERENCE POPULATION . This paper, pl.44(1-5), 5 specimens.
REFERENCE LOCALITY . S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 7, 338', U.Ecca.

HOLOTYPE . . . . . . This paper, pl.44(1).
TYPE LOCALITY . . . . As for reference locality.

NAME DERIVATION . . . Gr. labyrinthos = labyrinth; (ornamentation).

DESCRIPTION (ref. pop.):
- **Shape** . . . . . .]
- **Contact faces**. . . . .] as for genus.
- **Trilete mark** . . . . .]
- **Ornament.** Arrangement]
- Description . Vermiculate (sinuately reticulate).
- **Size** . . . . 32(34)36.

CLOSELY RELATED SPECIES

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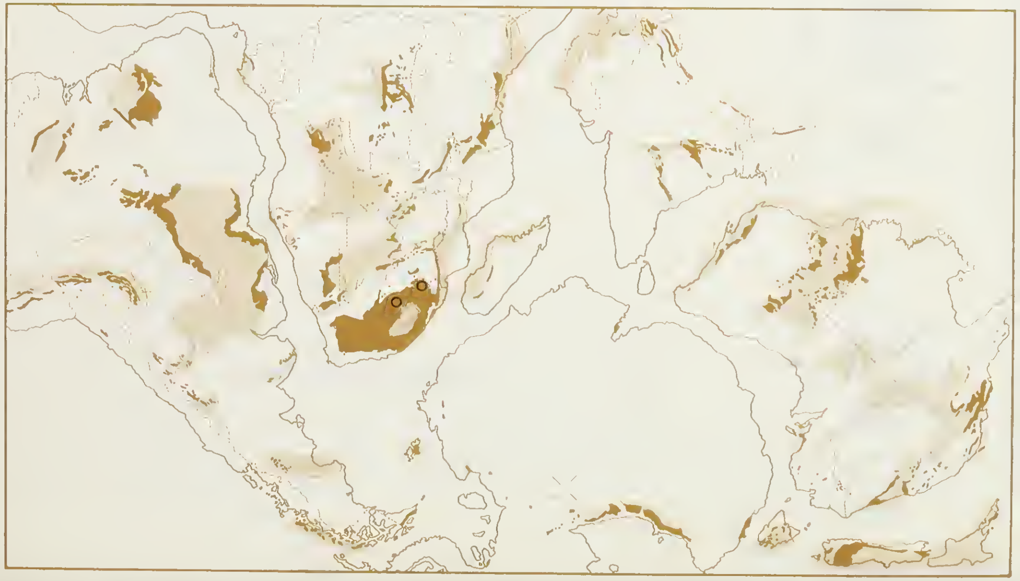
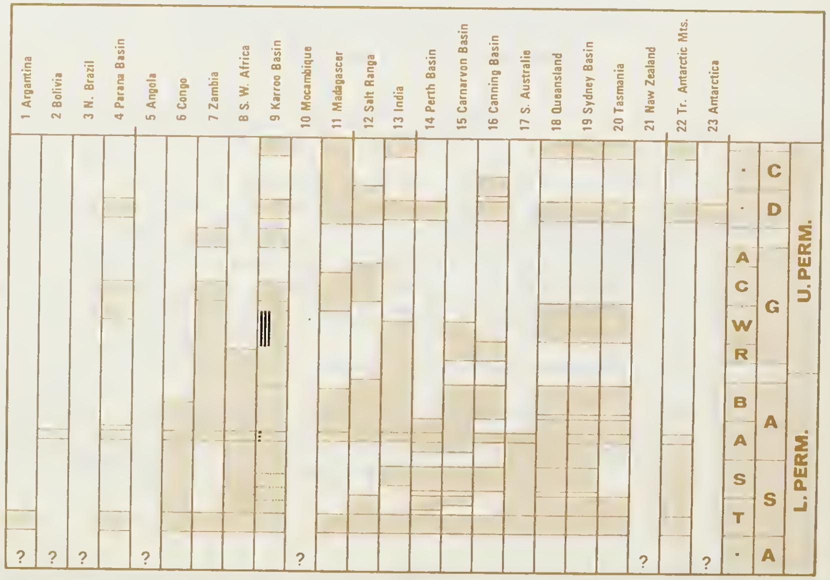
LITERATURE

9 Karroo Basin . This paper, pl.44(1-8).





Microbaculispora microreticulata sp. nov.

REFERENCE POPULATION	This paper, pl.44(9-31), 23 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1130', L.Ecca equivalent.
HOLOTYPE	This paper, pl.44(19).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION	Gr. mikros = small; L. reticulata = net like; (ornamentation).

DESCRIPTION (ref. pop.):

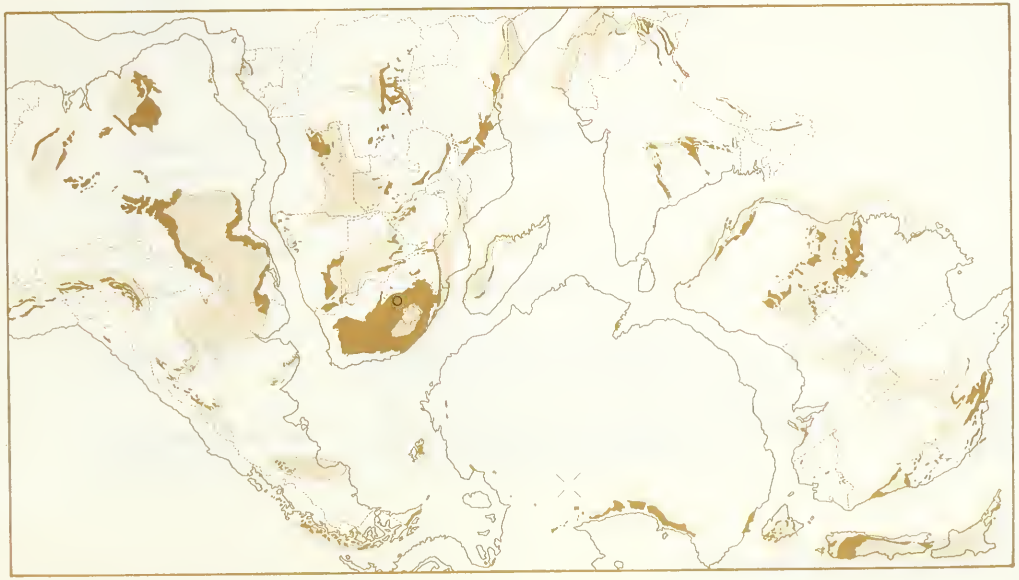
Shape	as for genus.
Contact faces	
Trilete mark	
Ornament. Arrangement	
Description	More or less indistinctly intrareticulate.
Size Equatorial diameter	42(51)60.

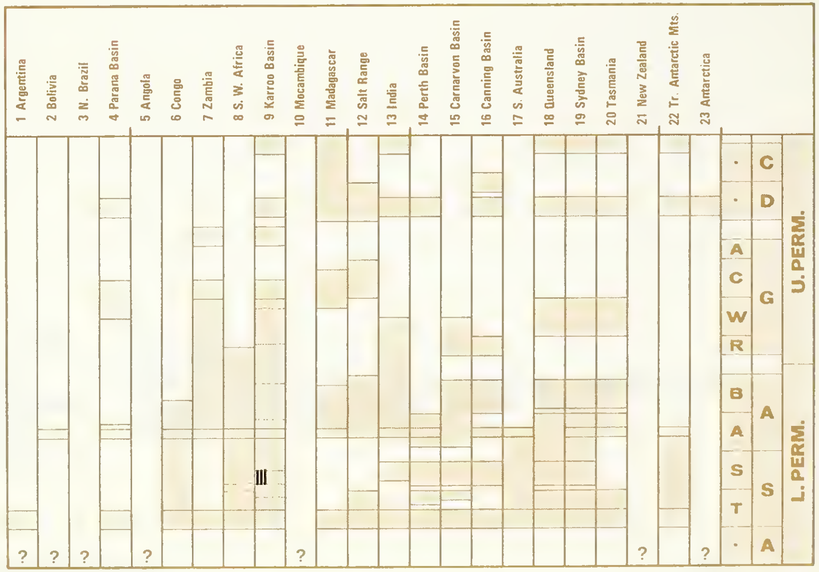
CLOSELY RELATED SPECIES

M.directa *M.plicata* *M.virkkiae*	⊕; pl.44(9-31) - pl.45(1-38).

LITERATURE

9	Karroo Basin	This paper, pl.44(9-31).





Microbaculispora virkkiae (Tiw.'65) comb. nov.

Leiotriletes virkkii Tiw.'65

REFERENCE POPULATION	This paper, pl.46(1-24), 24 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1151'3" to 1152'9", L.Ecca equivalent.
HOLOTYPE	Original designation, Tiw.'65, pl.1(2), p.170.
TYPE LOCALITY	India (M.P.), Korba Coalfield, 1008C, Borehole G-214, ? depth Barakar Stage.
NAME DERIVATION	After Dr. C. Virkki, palynologist.

DESCRIPTION (ref. pop.)

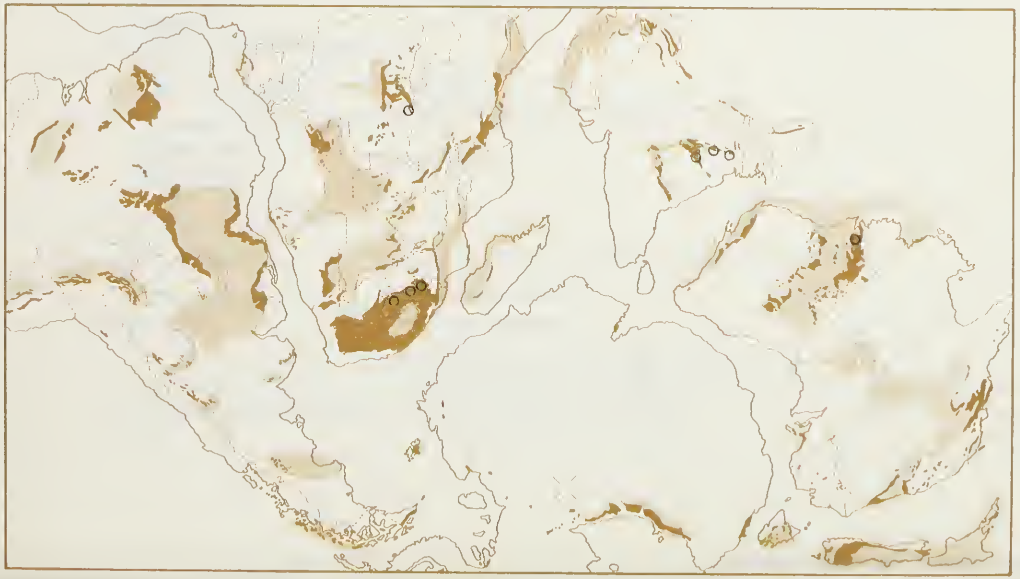
Shape	as for genus.
Contact faces	as for genus.
Trilete mark	as for genus.
Ornament. Arrangement	as for genus.
Description	Levigate to very indistinctly granulate.
Size	66(75)84.

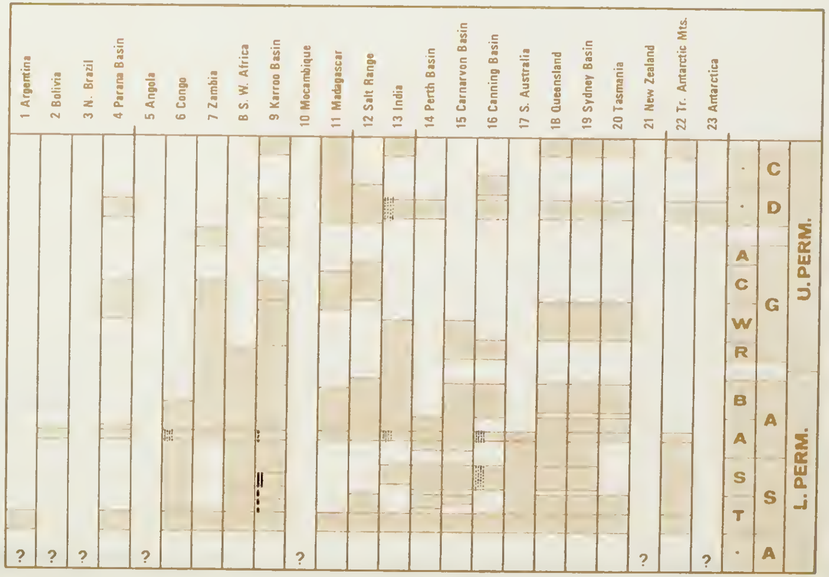
CLOSELY RELATED SPECIES

M.microreticulata *M.directa* *M. plicata*	⊕ ; pl.45(27-38) - pl.44(9-31), pl.45(1-26).
M.trisina	OO; pl.46(23) - pl.51(16).

LITERATURE

6	Congo	Mahesh. & Bose'69, pl.1(1).
9	Karroo Basin	This paper, pl.45(27-38), pl.46(1-24), pl.47(13,14,18,19).
13	India	Bharad.'62, pl.2(46); Bharad. & Sal.'64, pl.2(50); Tiw.'65, pl.1(2,3); Kar'69b, pl.1(1-4).
16	Canning Basin	Balme'73, pl.5(9), pl.7(15).





Microbaculispora plicata (Mahesh. & Bose '69) comb. nov.

Leiotriletes plicatus Mahesh. & Bose '69

REFERENCE POPULATION	This paper, pl.47(8-12), 5 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Greylingstad/Bethal/Hendrina area. Borehole, UC 678, 30,6m. to 31,6m.; M.Ecca.
HOLOTYPE	Original designation, Mahesh. & Bose '69, pl.1(10), p.11.
TYPE LOCALITY	Congo, Lukuga Coalfield area, Kibamba River. Surface locality, about 2,5km upstream from Lukuga-Kibamba confluence, ? Assise de Transition.
NAME DERIVATION	L.plico = to fold; (folding pattern in off-polar compressions).

DESCRIPTION (ref. pop.):

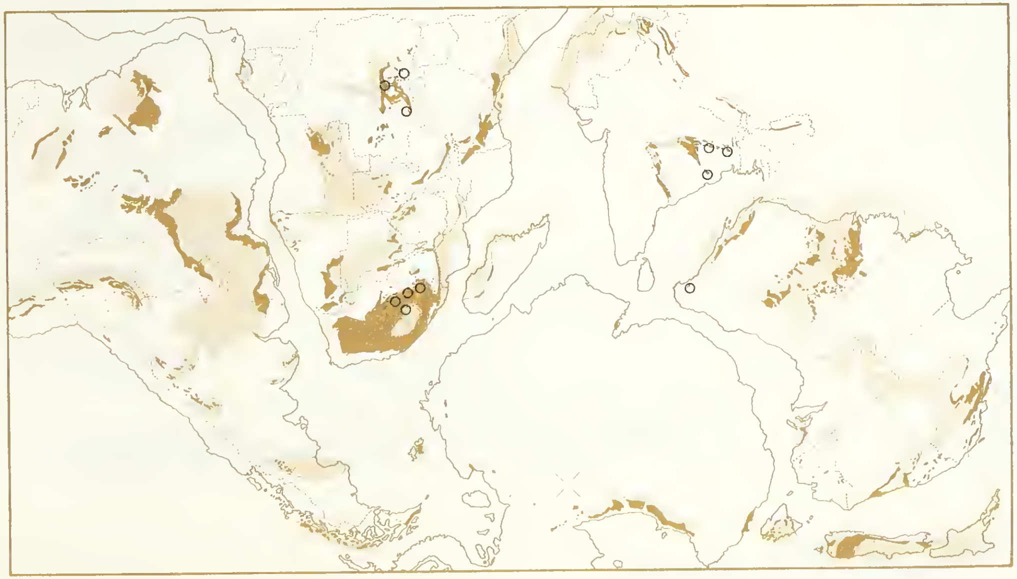
Shape	as for genus.
Contact faces	
Trilete mark	
Ornament. Arrangement	
Description	Levigate to very indistinctly granulate.
Size	54 (59) 64.

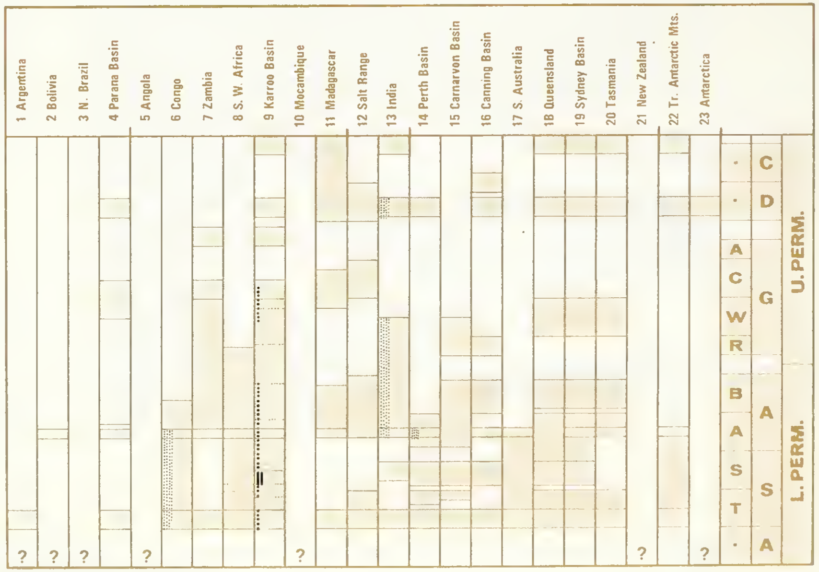
CLOSELY RELATED SPECIES

M.microreticulata *M.directa* *M.virkkiae*	⊕ ; pl.45(19-26) - pl.44(9-31), pl.45(1-18,27-38).
M.finegranulata	OO; pl.47(8-12) - pl.49(2).

LITERATURE

6	Congo	Bose & Kar '66, pl.1(5), pl.19(6), pl.30(14,18); Kar & Bose '67, pl.3(3); Mahesh. & Bose '69, pl.1(10-13).
9	Karroo Basin	This paper, pl.45(19-26), pl.47(8-12, 15-17, 20-27).
13	India	Bharad. '62; Venk. & Kar '65, pl.1(8-15); Kar '68a, pl.1(4); Sriv. '70, pl.1(1).
	Australia	Balme & Henn. '56b, pl.1(7); Balme '64, pl.3(4), pl.4(18).
14	Perth Basin	Glick. '72, pl.13(9).
18	Queensland	Hill & Woods '63, pl.P15(12).





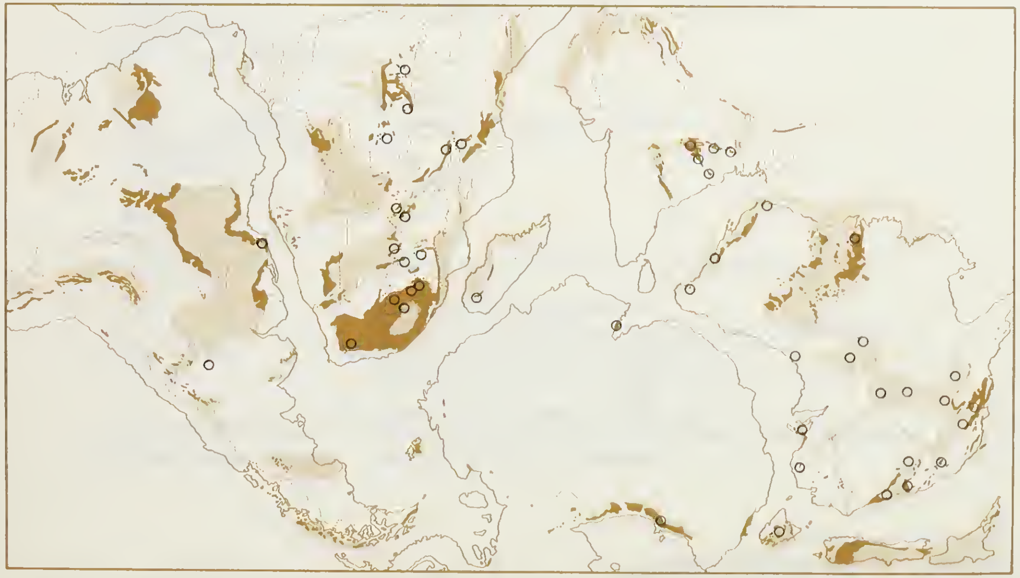
Microbaculispora directa (Balme & Henn.'56) comb. nov.

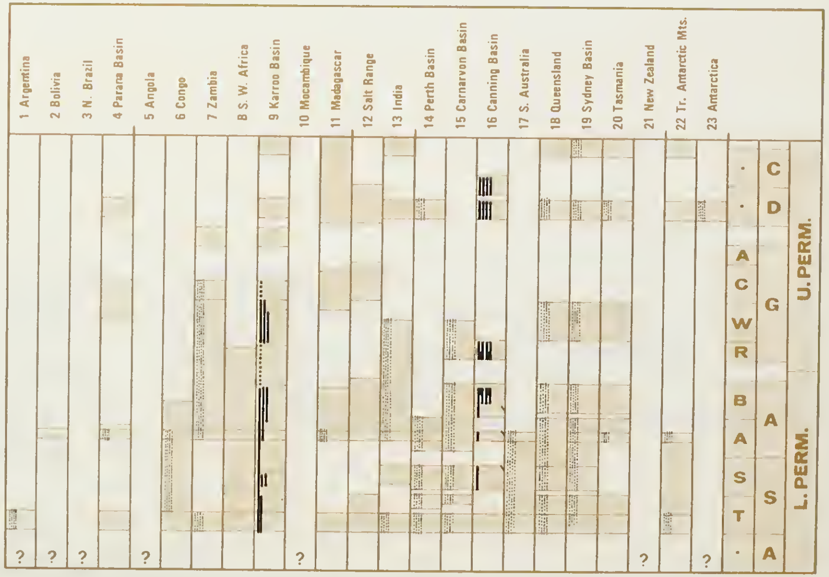
Leiotriletes directus Balme & Henn.56

REFERENCE POPULATION .	This paper, pl.47(1-7), 7 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Greylingstad/Bethal/Hendrina area. Borehole, UC 678, 30,6m. to 31,6m.; M.Ecca.
HOLOTYPE	Not designated to date.
TYPE LOCALITY	N.S.W., Sydney Basin. Borehole, South Wallarah No.5 (D.D.H.) seam at 688'; Newcastle C.M.
NAME DERIVATION . . .	L. directa = direct, simple; (lack of ornamentation).
DESCRIPTION (ref. pop.)	
Shape	as for genus.
Contact faces	as for genus.
Trilete mark	as for genus.
Ornament. Arrangement	as for genus.
Description .	Levigate to very indistinctly granulate.
Size	44(45)46.
CLOSELY RELATED SPECIES	
M.microreticulata *M.plicata* *M.virkkiae* . . .	⊕ ; pl.45(1-18) - pl.44(9-31), pl.45(19-38).
M.tentula	OO; pl.47(4) - pl.48(20).

LITERATURE

1	Argentina . .	Menend.'69, pl.2(14,15); Menend.'71, pl.1(1,2).
4	Parana Basin .	Pant. & Sriv.'65, pl.1(18-20).
6	Congo . . .	Pier.'59, pl.6(2,3); Bose & Kar'66, pl.18(12), pl.19(3-5), pl.30(1,19); Kar & Bose'67, pl.1(5), pl 2(8,9), pl.3(5); Bose & Mahesh.'68, pl.3(1,2), pl.4(3,4); Mahesh. & Bose'69, pl.1(2-5,9,14), pl.3(9).
7	Zambia . . .	Hart'63b, pl.1(9); Falc.'72, pl.1(12-15). (Utt.'70).
9	Karroo Basin .	This paper, pl.45(1-18), pl.47(1-7); Hart '66b).
11	Madagascar . .	Rakoto.'70, pl.1(1-3).
13	India	Pot. & Lele'61, pl.1(1-3); Bharad. & Sal.'65a, pl.1(23,25,26); Tiw.'65, pl.1(1); Bharad. & Tiw.'66, pl.1(11); Bharad.'66, pl.1(1); Nav. & Tiw.'67, pl.8(1); Venk. & Kar'68a, pl.1(1,2,8-10,28-30), pl.2(33-37); Kar'68a, pl.1(1,2,22); Tiw.'68a, pl.1(1,21,22); Saks.'71, pl.1(5); Lele & Karim'71, pl.1(2,4); Sinha'72, pl.1(21).
	Australia . . .	Balme & Henn.'56b, pl.1(3,4).
14	Perth Basin . .	Segr.'70, pl.1(E); Glick.'72, pl.13(8,10); (Balme & Henn.'56b; Segr.'72).
15	Carnarvon Basin .	(Balme & Henn.'56b; Balme'67).
16	Canning Basin .	Balme'73, pl.2(1), pl.3(1); (Balme & Henn.'56b; Balme'68).
17	S.Australia . .	(Evans'64b; Har. & Lud.'66; Har. & McG.'68, '71; Doug.'69).
18	Queensland . .	deJers.'70, pl.1(1); (Balme & Henn.'56b; Evans'64a,c,66a,b,c,'67a; Pat.'65; Burg.'70; Norv.'71; Rig.'73).
19	Sydney Basin .	Helby'70, pl.1(1); (Balme & Henn.'56b; Evans'67b; McK. & Gut.'69).
20	Tasmania . . .	(Balme & Henn.'56b; Banks & Naqvi'67).
22	Tr.Antarctic Mts.	(Kyle'73 letter; Bar. & Kyle (in press).
23	Antarctica . .	Kemp'69).





Microbaculispora tentula Tiw.'65

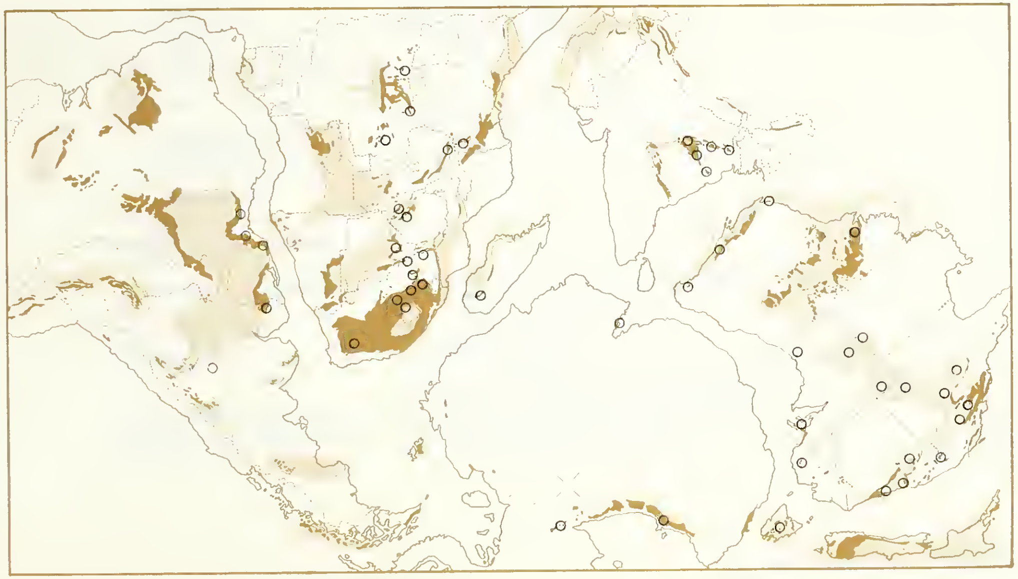
REFERENCE POPULATION .	This paper, pl.48(1-32), 32 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1133', L.Ecca equivalent.
HOLOTYPE	Original designation, Tiw.'65, pl.2(35), p.175.
TYPE LOCALITY	India (M.P.), Korba Coalfield, NS/165/S. Borehole K-63, ? depth; Barakar Stage.
NAME DERIVATION . . .	? L. tentorium = tent; (ornamentation).
DESCRIPTION (ref. pop.)	
Shape	as for genus.
Contact faces	as for genus.
Trilete mark	as for genus.
Ornament. Arrangement	as for genus.
Description .	Finely granulate (elements: 10 per 10mu).
Size	34(42)50.

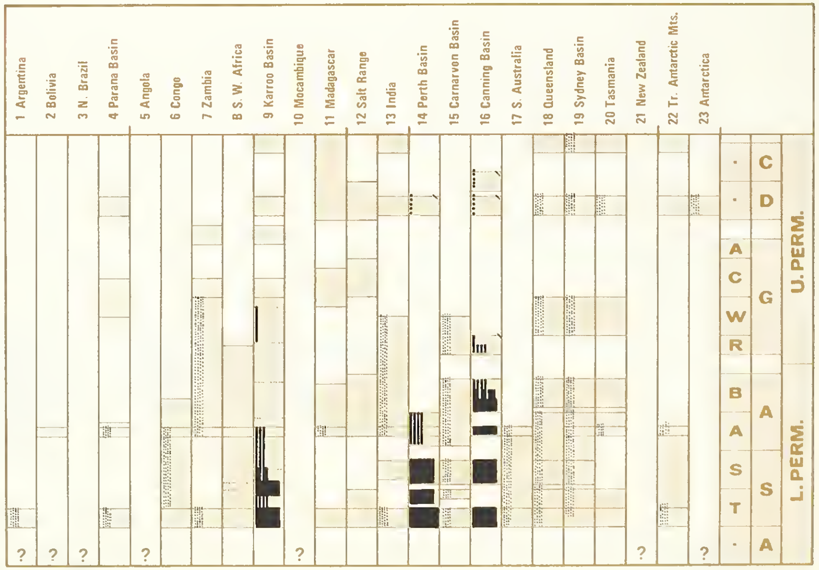
CLOSELY RELATED SPECIES

M.directa	OO; pl.48(20) - pl.47(4).
M.mediogranulata . . .	OO ; pl.48(47) - pl.49(10).
M.micronodosa	OO; pl.48(47) - pl.50(17).
M.paratentula	OO; pl.48(5) - pl.60(13).

LITERATURE

1	Argentina . .	Menend.'69, pl.2(14,15); Menend.'71, pl.1(1,2).
4	Parana Basin . .	Pant. & Sriv.'65, pl.1(18-20); Tiw. & Nav.'67, pl.1(5-7); Bharad.'69, pl.1(14,15); Kemp (in press), pl.1(2).
6	Congo . . .	Bose & Kar'66, pl.18(1,2), pl.19(3-5), pl.30(1,19); Kar & Bose'67, pl.1(5), pl.2(8,9,11), pl.3(5); Bose & Mahesh.'68, pl.3(1,2), pl.4(3,4); Mahesh. & Bose'69, pl.2(18), pl.3(9); (Mahesh.'69).
7	Zambia . . .	Hart'63b, pl.1(9); Falc.'72, pl.2(9-18,20); (Utt.'70).
9	Karroo Basin .	This paper, pl.48(1-57); (Hart '66b).
11	Madagascar . .	Rakoto.'70, pl.1(4-12), pl.2(1-13).
13	India	Pot. & Lele'61, pl.1(1-3); Tiw.'65, pl.1(1), pl.2(35-37,42); Bharad. & Tiw.'66, pl.1(1); Bharad.'66, pl.1(1), pl.3(24); Nav. & Tiw.'67, pl.8(1); Venk. & Kar'68a, pl.1(1,2,8-10,28-30), pl.2(33-37); Kar'68a, pl.1(1,2,22); Tiw.'68a, pl.1(1,21,22); Saks.'71, pl.1(5); Lele & Karim'71, pl.1(2,4); Sinha'72, pl.1(21).
	Australia . . .	Balme & Henn.'56b, pl.1(1,2); Balme'64, pl.3(1).
14	Perth Basin . .	Segr.'70, pl.2(D-G); Segr.'72, pl.1(1), pl.2(1); Glick.'72, pl.11(5,6); (Balme & Henn.'56b).
15	Carnarvon Basin .	(Balme & Henn.'56b; Balme'67).
16	Canning Basin .	Balme'73, pl.4(4), pl.5(2), pl.7(2), pl.8(1,2); (Balme & Henn.'56b; Balme'68).
17	S.Australia . .	Evans'64b, pl.1(5-7); (Har. & Lud.'66; Har. & McG.'68,'71; Doug.'69)
18	Queensland . .	deJers.'70, pl.1(1); (Balme & Henn.'56b; Evans'64a,c,'66a,b,c,'67a; Pat.'65; Burg.'70; Norv.'71; Rig.'73).
19	Sydney Basin .	Helby'70, pl.1(1); (Balme & Henn.'56b, Evans'67b, McK. & Gut.'69).
20	Tasmania . . .	(Balme & Henn.'56b; Banks & Naqvi'67).
22	Tr. Antarctic Mts.	Kemp (in press), pl.2(19); (Kyle'73 letter; Bar. & Kyle (in press)).
23	Antarctica . .	Balme & Playf.'67, pl.1(2); (Kemp'69).





Microbaculispora finegranulata sp. nov.

REFERENCE POPULATION	This paper, pl.49(1-9), 9 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Sasolburg area. Borehole, P 13, 153,39m, L.Ecca equivalent.
HOLOTYPE	This paper, pl.49(3).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION	L.finis = small; L.granulatus = grainy, (ornamentation).

DESCRIPTION (ref. pop.)

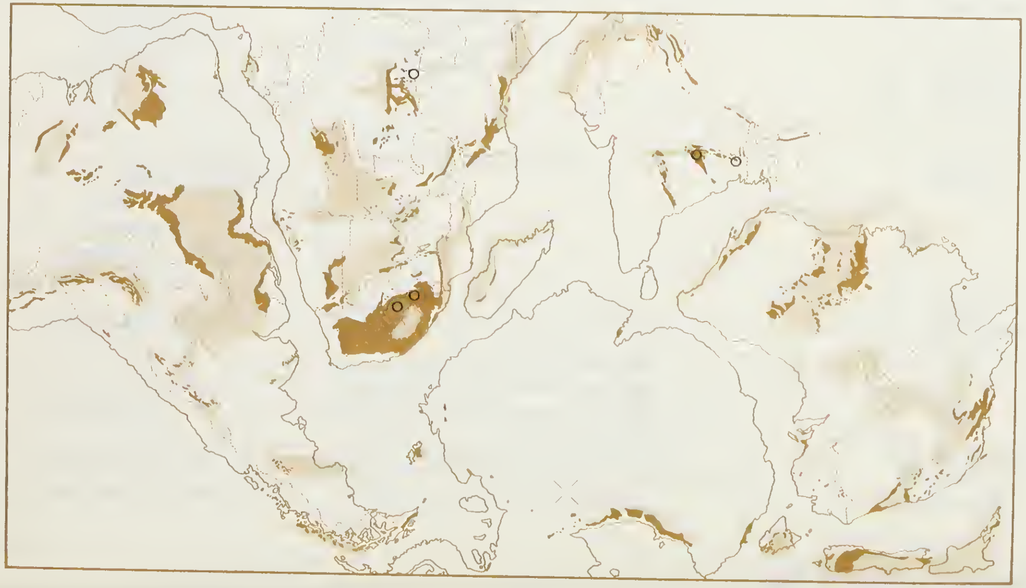
Shape	as for genus.
Contact faces	as for genus.
Trilete mark	as for genus.
Ornament. Arrangement	as for genus.
Description	Finely granulate (elements: 12 per 10 mu).
Size	50(53)56.

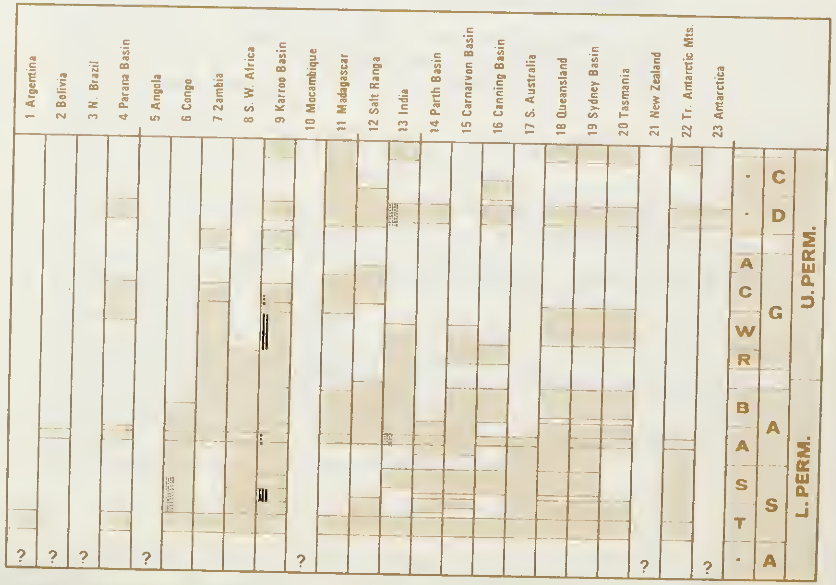
CLOSELY RELATED SPECIES

M.plicata	OO; pl.49(2) - pl.47(8-12).
M.trisina	OO ; pl.49(6) - pl.51(1).

LITERATURE

6	Congo	Bose & Kar'66, pl.19(14,15).
9	Karroo Basin	This paper, pl.49(1-9).
13	India	Bharad.'62, pl.2(47); Sinha'72, pl.1(23,24).
	Australia	Balme & Henn.'56b, pl.1(8).





Microbaculispora mediogranulata sp. nov.

REFERENCE POPULATION	This paper, pl.49(10-37), 28 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1151'3" to 1152'9", L.Ecca equivalent.
HOLOTYPE	This paper, pl.49(16).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION	L. medius = medium; L. granulatum = grainy; (ornamentation).

DESCRIPTION (ref. pop.)

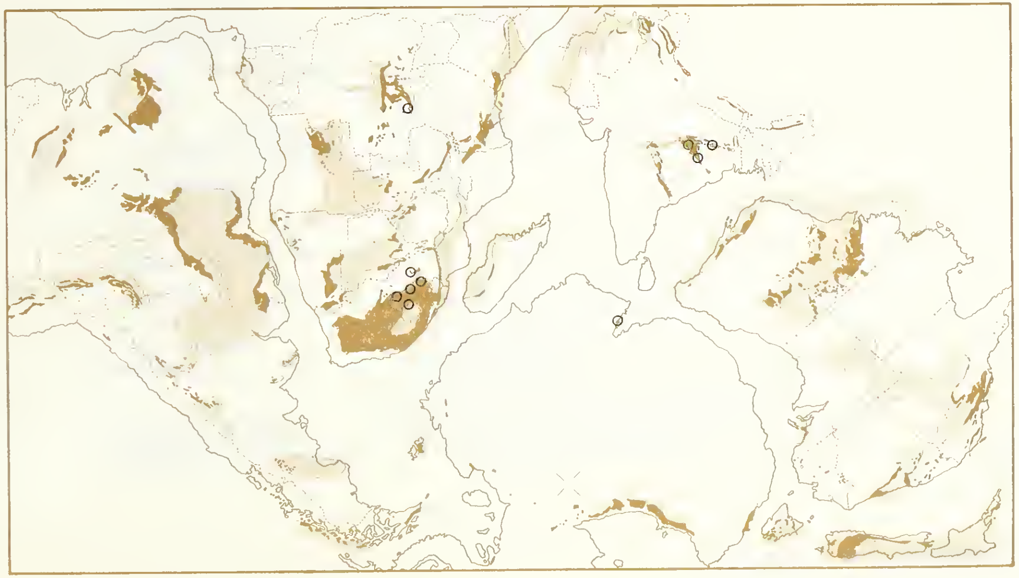
Shape	as for genus.
Contact faces	as for genus.
Trilete mark	as for genus.
Ornament. Arrangement	as for genus.
Description	Coarsely granulate to intrareticulate (elements: 6 per 10mu).
Size	44(52)60.

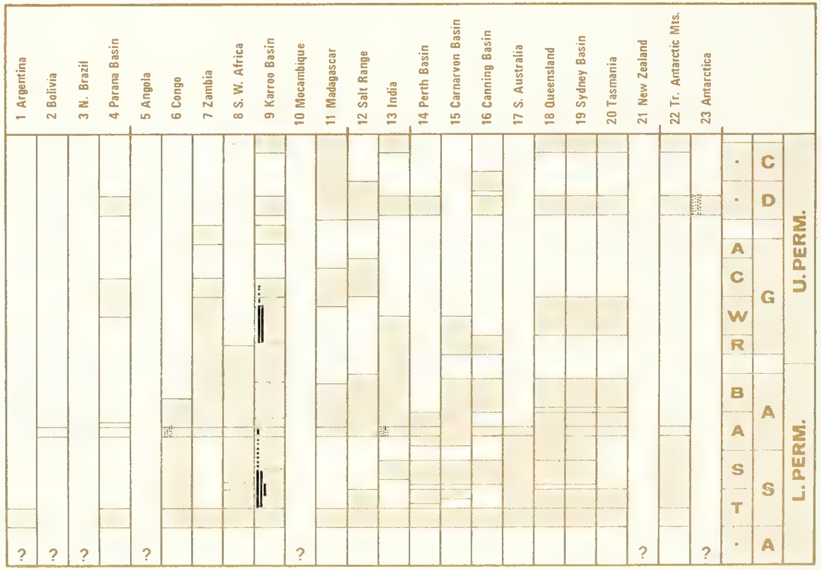
CLOSELY RELATED SPECIES

M.tentula	OO ; pl.49(10) - pl.48(47).
M.grandegranulata	OO ; pl.49(23) - pl.49(45).
M.micronodosa	OO; pl.49(14) - pl.50(11).

LITERATURE

6	Congo	Bose & Mahesh.'68, pl.4(14); Mahesh. & Bose'69, pl.2(19,20).
9	Karroo Basin	This paper, pl.49(10-37).
13	India	Tiw.'65, pl.2(33,34,40,41); Bharad.'66, pl.3(23,29); Venk. & Kar'68a,pl.1(31,32); Saks.'71, pl.1(18,19).
23	Antarctica	Balme & Playf.'67, pl.1(5).





Microbaculispora grandegranulata sp. nov.

REFERENCE POPULATION	This paper, pl.49(38-43), 6 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, UC 729, 556,0 m., Dwyka Tillite.
HOLOTYPE	This paper, pl.49(38).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION	L. grandis = large; L. granulatus = grainy; (ornamentation).

DESCRIPTION (ref. pop.)

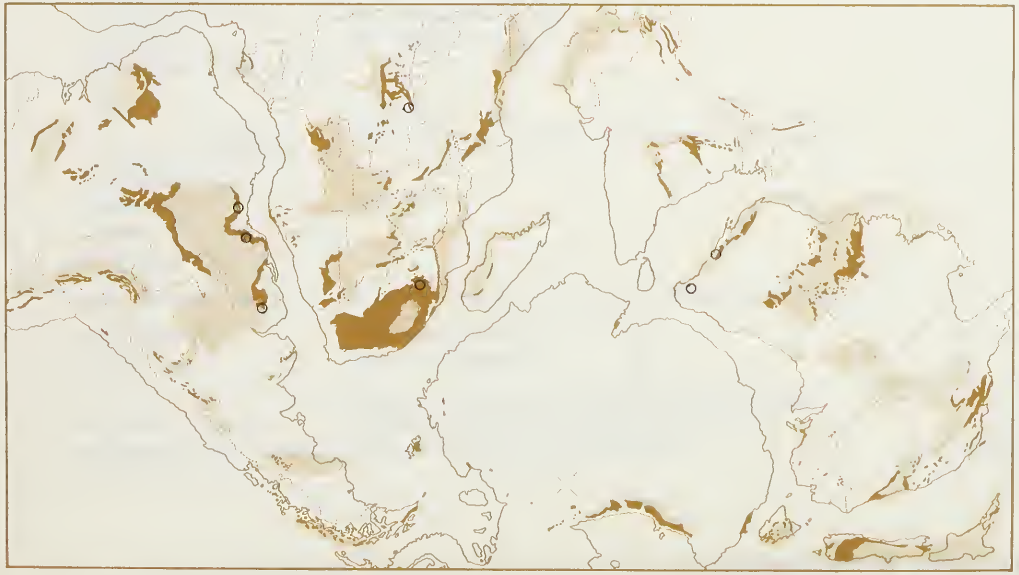
Shape	as for genus.
Contact faces	as for genus.
Trilete mark	as for genus.
Ornament. Arrangement	as for genus.
Description	Irregularly intrareticulate (elements: 5 per 10mu).
Size	42(45) 48.

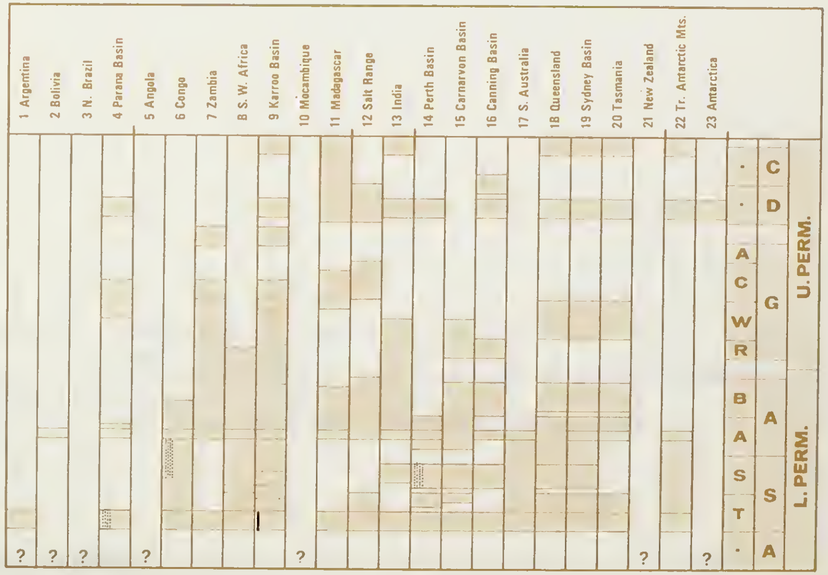
CLOSELY RELATED SPECIES

M.mediogranulata	$\underline{O}\underline{D}$; pl.49(45) - pl.49(23).
M.dwykaensis	$\underline{O}\underline{O}$; pl.49(40) - pl.58(1).

LITERATURE

4	Parana Basin	Bharad.'69, pl.1(16,17); Kemp (in press), pl.1(10,11).
6	Congo	Bose & Mahesh.'68, pl.4(15).
9	Karroo Basin	This paper, pl.49(38-45).
14	Perth Basin	Segr.'70, pl.2(B); Glick.'72, pl.11(1-4,7).





Microbaculispora micronodosa (Balme & Henn.'56) comb. nov.

Granulatisporites micronodosus Balme & Henn.'56

REFERENCE POPULATION	This paper, pl.50(1-15), 15 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Greylingstad/Bethal/Hendrina area. Borehole, UC 678, 30,6m. to 31,6m., M.Ecca.
HOLOTYPE	Not designated to date.
TYPE LOCALITY	N.S.W., Sydney Basin. Borehole, South Wallarah No.5(D.D.H.), seam at 685,' Newcastle C.M.
NAME DERIVATION	Gr. mikros = small; L. nodosa = knotty; (ornamentation).

DESCRIPTION (ref. pop.)

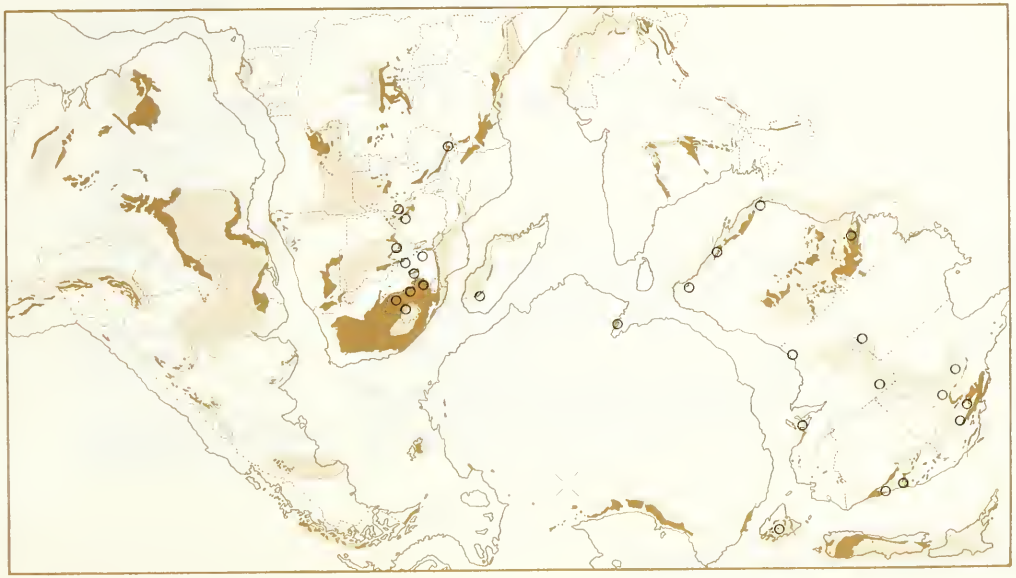
Shape	as for genus.
Contact faces	as for genus.
Trilete mark	as for genus.
Ornament. Arrangement	as for genus.
Description	Papillate.
Size	38(48)58.

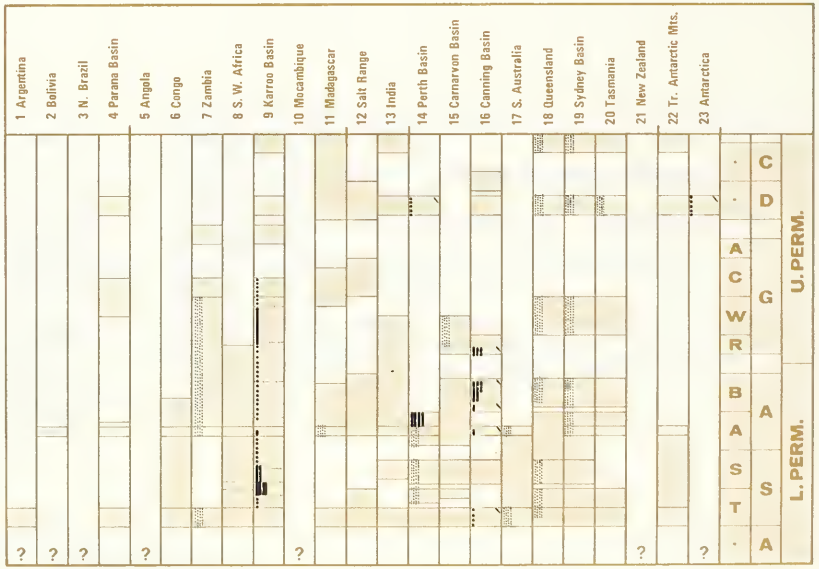
CLOSELY RELATED SPECIES

M. tentula	OO; pl.50(17) - pl.48(47).
M.mediogranulata	OO; pl.50(11) - pl.49(14).
M.paramicronodosa	Φ ; pl.50(24-30) - pl.60(1-6).

LITERATURE

7	Zambia	Falc.'72, pl.2(19,24,25); (Utt.'70).
9	Karroo Basin	This paper, pl.50(1-37); (Hart'66b).
11	Madagascar	Rakoto.'70, pl.5(20).
	Australia	Balme & Henn.'56b, pl.1(9,10).
14	Perth Basin	Segr.'70, pl.2(C); Glick.'72, pl.8(13,14); (Balme & Henn.'56b).
15	Carnarvon Basin	(Balme'67).
16	Canning Basin	Balme'73, pl.3(4); (Balme & Henn.'56b; Balme'68).
17	S.Australia	(Evans'64b; Har. & Lud.'66; Har. & McG.'68.
18	Queensland	(Balme & Henn'56b; Evans'64a,c,66a,b,c,'67a; Pat'65; deJers.'70, pl.1(9); Norv.'71; Rig.'73.
19	Sydney Basin	Balme & Henn.'56b, pl.1(9-10); Helby'70, pl.2(9,13,14,17,18); (Evans'67b; McK. & Gut.'69).
20	Tasmania	(Banks & Naqvi'67).
23	Antarctica	Balme & Playf.'67, pl.1(6); (Kemp'69).





Microbaculispora trisina (Balme & Henn.'56) comb. nov.

Granulatrisporites trisinus Balme & Henn.'56

REFERENCE POPULATION	This paper, pl.51(1-18), 18 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Greylingstad/Bethal/Hendrina area. Borehole, UC 678, 30,6m. to 31,6m., M.Ecca.
HOLOTYPE	Not designated to date.
TYPE LOCALITY	N.S.W., Sydney Basin, Western Coalfield. Kandos Colliery, Lithgow seam, Newcastle C.M.
NAME DERIVATION	L. tres = three; L. sinus = curved surface; (contact faces).

DESCRIPTION (ref. pop.)

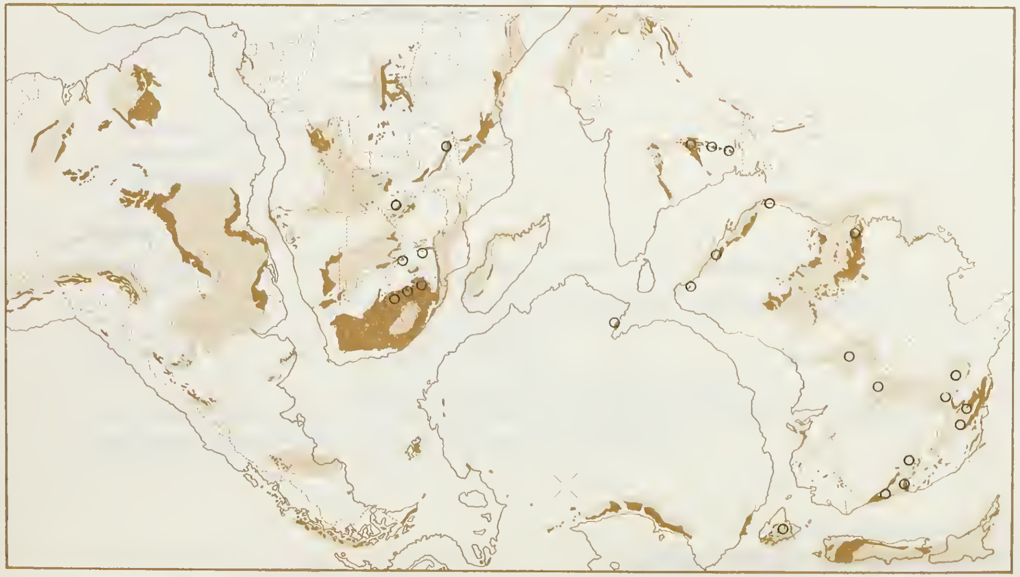
Shape	as for genus.
Contact faces	as for genus.
Trilete mark	as for genus.
Ornament. Arrangement	as for genus.
Description	Granulate to conate (elements: 6–10 per 10mu; 1 mu high).
Size	56(78) 100.

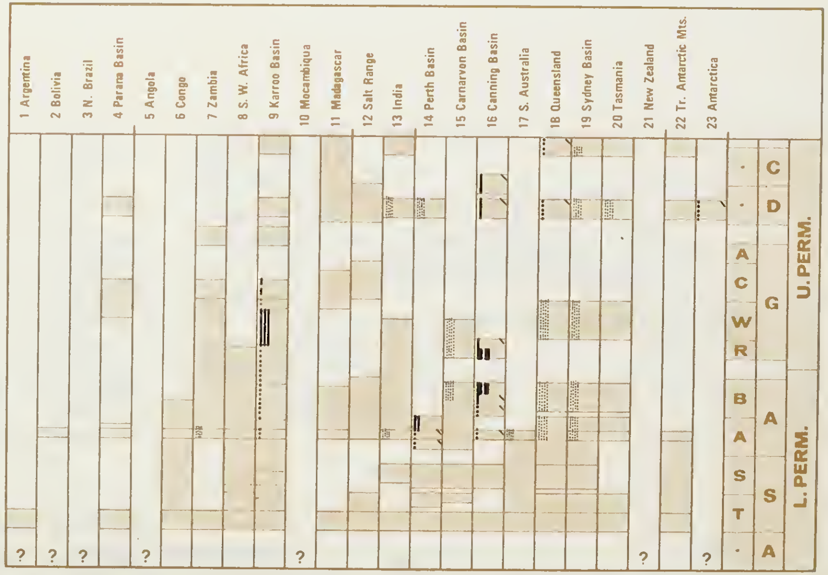
CLOSELY RELATED SPECIES

M.finegranulata	①; pl.51(1) - pl.49(6).
M.gondwanensis	①; pl.51(in full) - pl.52(in full).

LITERATURE

7	Zambia	(Utt.'70).
9	Karroo Basin	This paper, pl.51(1-18), pl.53(1-12); (Hart '66b).
13	India	Bharad.'62, pl.3(50-53); Tiw.'65, pl.2(43,44); Sinha'72, pl.1(22).
	Australia	Balme & Henn.'56b, pl.1(5,6); Balme'64, pl.4(4).
14	Perth Basin	Segr.'70, pl.1(A-D); Segr.'72, pl.5(10); Glick.'72, pl.9(7), pl.10(2-4); (Balme & Henn.'56b).
15	Carnarvon Basin	(Balme & Henn. '56b; Balme'67).
16	Canning Basin	Balme'71, pl.2(22), pl.3(7); (Balme & Henn.'56b; Balme'68).
17	S.Australia	(Har. & McG.'68).
18	Queensland	(Balme & Henn.'56b; Evans'64a,c,'66a,b,c,'67a; Pat.'65,69; Burg.'70; deJers.'70; Norv.'71; Rig.'73).
19	Sydney Basin	Helby'70, pl.2(15,16,20,21); (Balme & Henn.'56b; Evans'67b; McK. & Gut.'69).
20	Tasmania	(Balme & Henn.'56b; Banks & Naqvi'67).
23	Antarctica	(Balme & Playf.'67, pl.1(8).





Microbaculispora gondwanensis Bharad.'62

REFERENCE POPULATION .	This paper, pl.52(1-20), 20 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Greylingstad/Bethal/Hendrina area. Borehole, UC 678, 30,6m. to 31,6m., M.Ecca.
HOLOTYPE	Original designation, Bharad.'62, pl.2(33), p.81.
TYPE LOCALITY	India, E. Raniganj Coalfield. Samla-Rendra Colliery, Samla seam, Raniganj Stage.
NAME DERIVATION . . .	After Gondwanaland.

DESCRIPTION (ref. pop.)

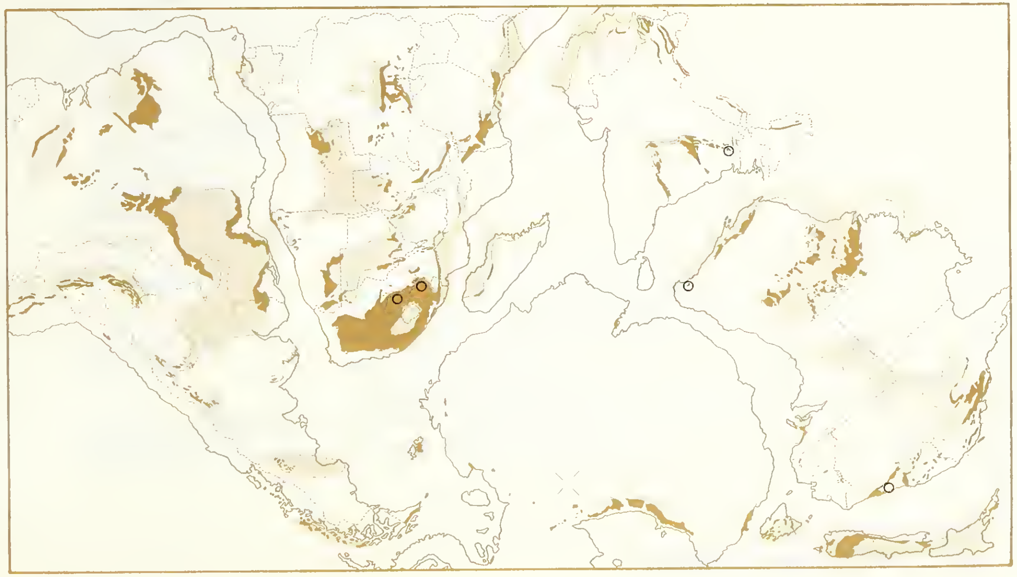
Shape	as for genus.
Contact faces	
Trilete mark	
Ornament. Arrangement .	
Description .	Conate to spinate (elements: 6 per 10mu; 1-2mu high).
Size	58(79)100.

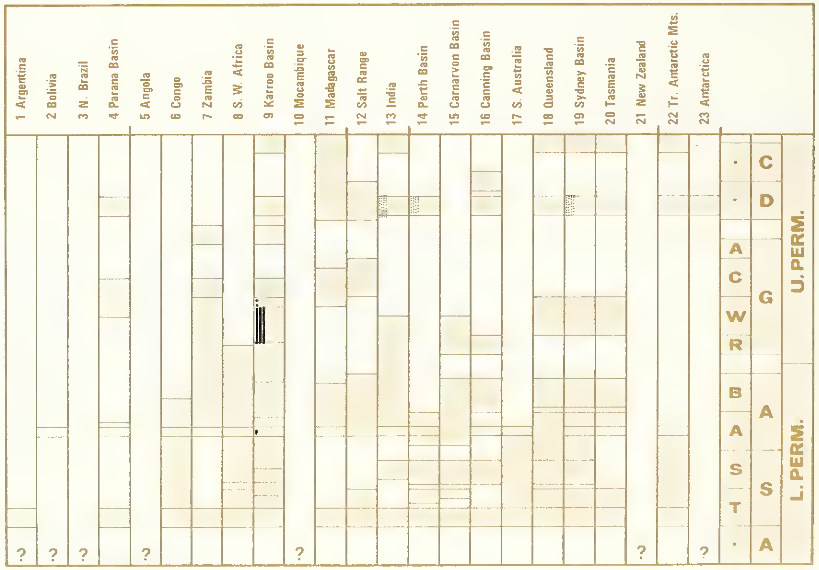
CLOSELY RELATED SPECIES

M.trisina	⦶ ; pl.52(in full) - pl.51(in full).
M.villosa	⦶⦶; pl.53(23) - pl.54(4).

LITERATURE

9	Karroo Basin .	This paper, pl.52(1-20), pl.53(13-24).
13	India	Bharad.'62, pl.2(33-35).
14	Perth Basin . .	Glick.'72, pl.9(6).
19	Sydney Basin .	Helby'70, pl.2(19).





Microbaculispora villosa (Balme & Henn.'56) Bharad.'62

Acanthotriletes villosus Balme & Henn.'56

REFERENCE POPULATION . This paper, pl.54(1-8), 8 specimens.

REFERENCE LOCALITY . S.Africa, northern Karroo Basin, Welkom/Virginia area.
Borehole, SAP 7, 338', U.Ecca.

HOLOTYPE . . . . . . Not designated to date.

TYPE LOCALITY . . . . N.S.W., Sydney Basin, Western Coalfield.
Kandos Colliery, Lithgow seam, Newcastle C.M.

NAME DERIVATION . . . L. villosa = shaggy, hairy; (ornamentation).

DESCRIPTION (ref. pop.)

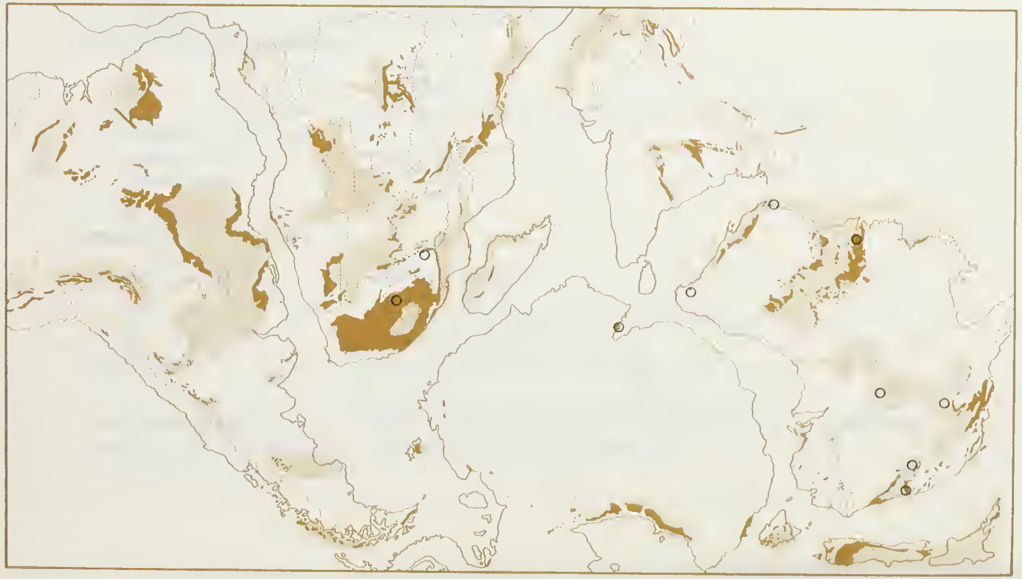
Shape . . . .
Contact faces . . . .
Trilete mark . . . . .
Ornament. Arrangement .] as for genus.
Description . Elongately spinate (elements: 6 per 10 mu; 2-3mu high).
Size . . . . 74(82) 90

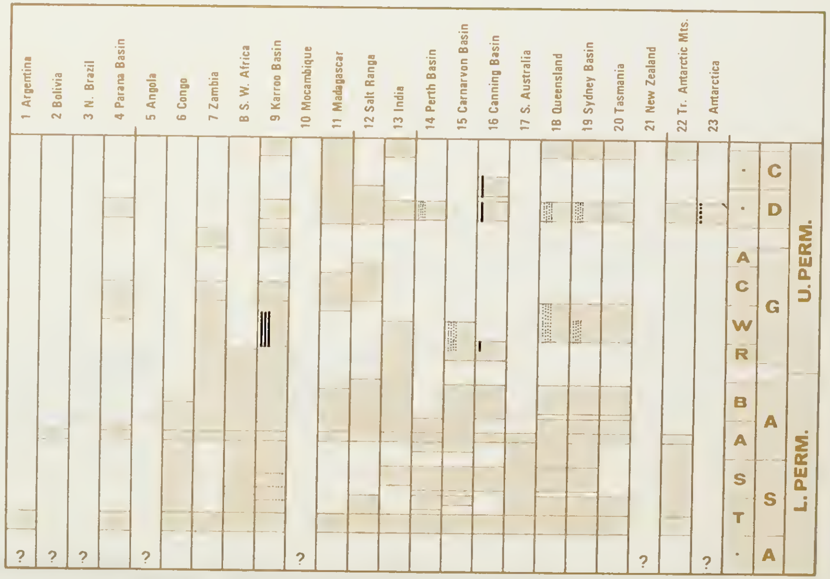
CLOSELY RELATED SPECIES

M.gondwanensis . . . . ꝏ ; pl.54(4) - pl.53(23).
M.ericiana . . . . . OO; pl.54(10) - pl.55(1).

LITERATURE

9	Karroo Basin	This paper, pl.54(1-10).
13	India	Tiw.'65, pl.2(31).
	Australia	Balme & Henn.'56b, pl.3(37,38); Balme, pl.4(12).
14	Perth Basin	Glick.'72, pl.9(4,5), pl.10(1); (Balme & Henn.'56b).
15	Carnarvon Basin	(Balme'67).
16	Canning Basin	Balme'73, pl.2(23); (Balme'68).
18	Queensland	(Evans'64a,c,'66a,b,c,'67a; Rig.'73).
19	Sydney Basin	(Balme & Henn.'56b; Evans'67b).
23	Antarctica	Balme & Playf.'67, pl.1(9); (Kemp'69).





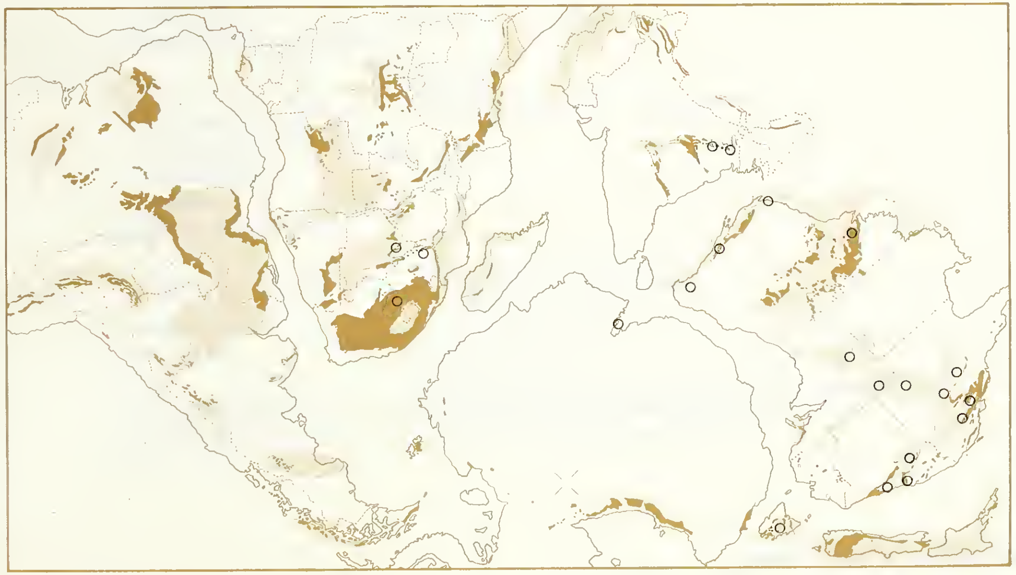
Microbaculispora ericiana (Balme & Henn.'56) comb. nov.

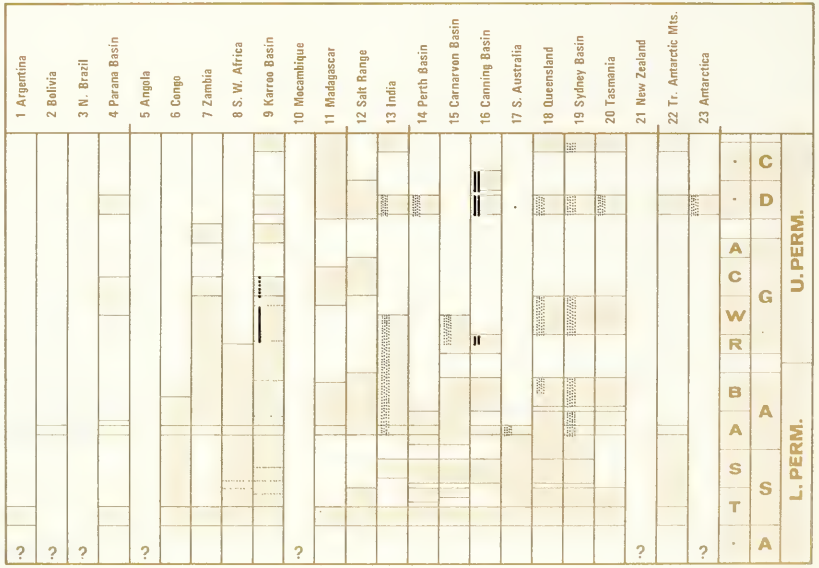
Acanthotriletes ericianus Balme & Henn.'56

REFERENCE POPULATION .	This paper, pl.55(3-6), 4 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 7, 338', U.Ecca.
HOLOTYPE	Designated by Balme & Playf.'67; Balme & Henn.'56, pl.3(30), p.248.
TYPE LOCALITY	N.S.W., Sydney Basin, Western Coalfield. Wallerawang Colliery, Lithgow seam, Newcastle Stage.
NAME DERIVATION . . .	L. ericius = hedgehog; (ornamentation).
DESCRIPTION (ref. pop.)	
Shape	as for genus.
Contact faces	as for genus.
Trilete mark	as for genus.
Ornament. Arrangement .	as for genus.
Description .	Spinate (elements: 3 per 10mu; 3mu high).
Size	76(77)78.
CLOSELY RELATED SPECIES	
M.villosa	OO; pl.55(1) - pl.54(1).
M.eoericiana	OO; pl.55(1) - pl.55(13).

LITERATURE

9	Karroo Basin .	This paper, pl.55(1-6); (Hart'66b).
13	India	Bharad.'62, pl.1(16,17); Bharad. & Sal.'65a, pl.1(13,19,20); Bharad. et. al., '65, pl.1(3-5); Venk. & Kar'65, pl.1(1-7); Venk. & Kar'68c, pl.1(2).
	Australia . . .	Balme & Henn.'56b, pl.3(30-33); Balme'64, pl.4(11).
14	Perth Basin . .	Segr.'70, pl.6(E); Segr.'72, pl.6(I); (Balme & Henn.'56b).
15	Carnarvon Basin .	(Balme'67).
16	Canning Basin .	Balme'73, pl.2(15); (Balme'68).
17	S.Australia . .	(Har. & McG.'68).
18	Queensland . .	Hill & Woods'63, pl.15(11); (Balme & Henn.'56b; Evans'64a,c,'66a,b,c,'67a; Pat.'65,'69; deJers.'70; Norv.'71; Rig.'73).
19	Sydney Basin .	Dulh.'45, pl.7(16A); Helby'70, pl.4(11,15,18-20); (Balme & Henn.'56b; Evans'67b).
20	Tasmania . . .	(Banks & Naqvi'67).
23	Antarctica . .	(Balme & Playf.'67).



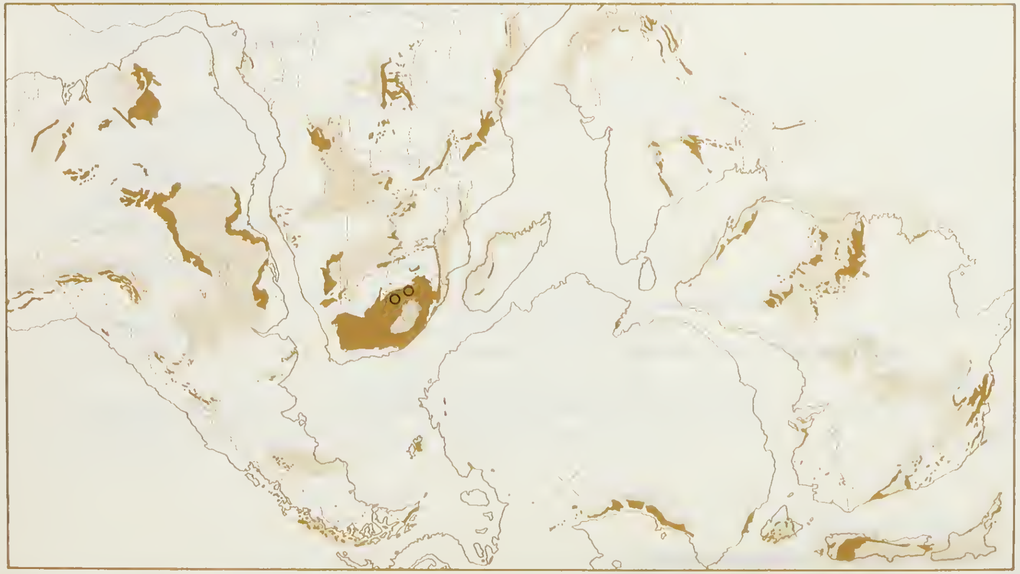


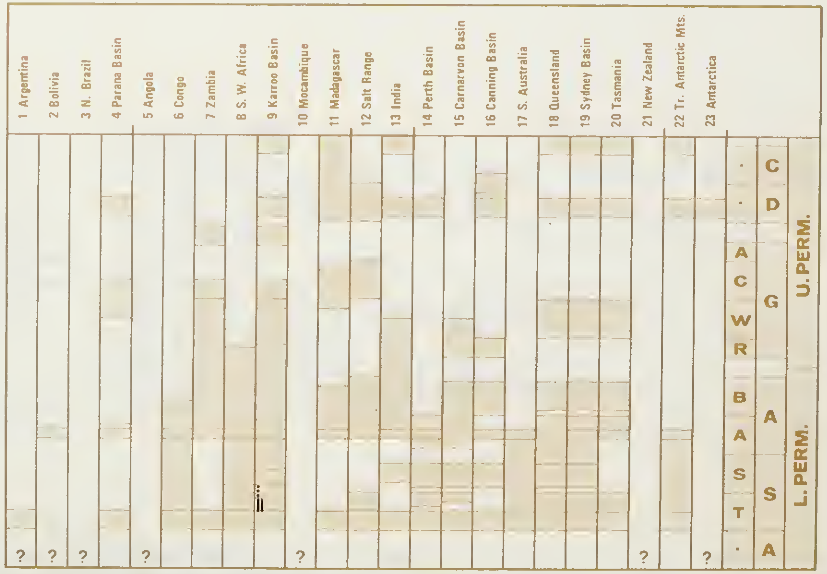
Microbaculispora eoericiana sp. nov.

REFERENCE POPULATION .	This paper, pl.55(7-20), 14 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1151'3" to 1152'9", L.Ecca equivalent.
HOLOTYPE	This paper, pl.57(12).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION . . .	Gr. eos = early; L. ericius = hedgehog; (possibly ancestral to *M.ericiana*).
DESCRIPTION (ref. pop.)	
Shape	as for genus.
Contact faces	
Trilete mark	
Ornament. Arrangement .	
Description .	Granulate & spinate (elements intermixed).
Size	56(64)72.
CLOSELY RELATED SPECIES	
M.ericiana	OO; pl.55(13) - pl.55(1).

LITERATURE

9	Karroo Basin .	Hart '63, pl.1(15);	This paper, pl.55(7-20).





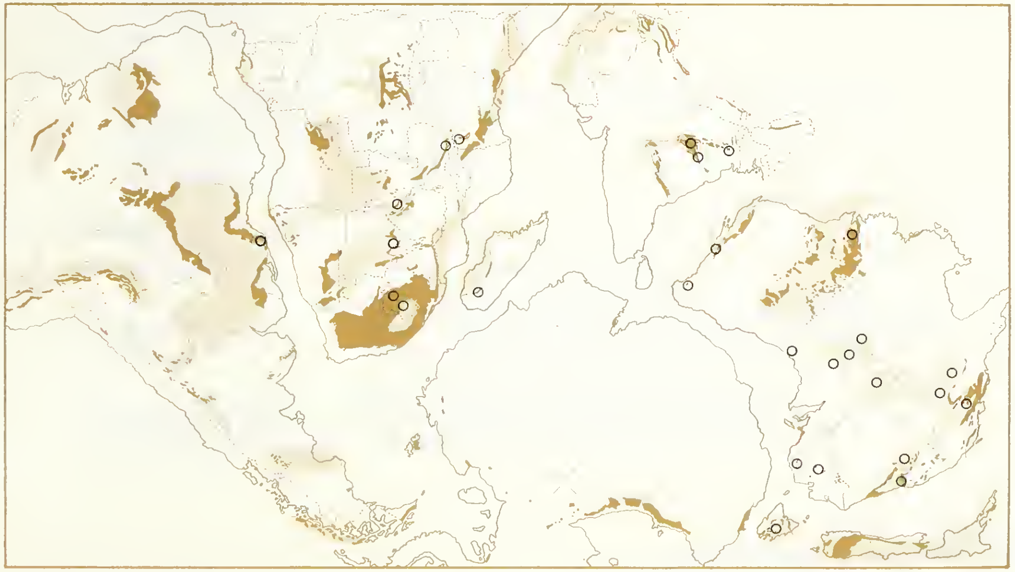
Microbaculispora pseudoreticulata (Balme & Henn.'56) comb. nov.

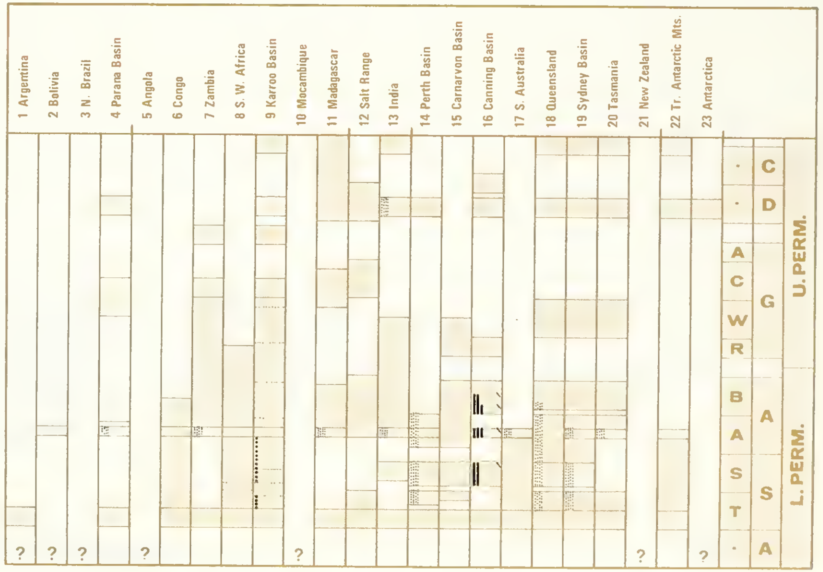
Verrucosisporites pseudoreticulatus Balme & Henn.56

REFERENCE POPULATION .	This paper, pl.56(1-16), 16 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1151'3" to 1152'9", L.Ecca equivalent.
HOLOTYPE	Not designated to date.
TYPE LOCALITY	N.S.W., Sydney Basin. Muswellbrook Open Cut, Muswellbrook seam, Greta Coal Measures.
NAME DERIVATION . . .	Gr. pseudos = falsity; L. reticulata = net-like; (ornamentation).
DESCRIPTION (ref. pop.)	
Shape	as for genus.
Contact faces	as for genus.
Trilete mark	as for genus.
Ornament. Arrangement .	as for genus.
Description .	Irregularly intrareticulate to verrucate (elements: 4 per 10mu).
Size	76(81)86.
CLOSELY RELATED SPECIES	
M.naumovae	OO; pl.56(3) - pl.57(4).
M.irregularis	OO; pl.56(3) - pl.58(22).

LITERATURE

4	Parana Basin . .	Pant. & Sriv.'65, pl.1(22).
7	Zambia . . .	Hart'60, pl.3(36); (Utt.'70).
9	Karroo Basin .	This paper, pl.56(1-16); (Hart'66b).
11	Madagascar . .	Rakoto.'70, pl.7(1-6).
13	India	Bharad.'62, pl.2(43-44); Bharad. & Tiw.'64b, pl.1(8); Tiw.'65, pl.2(32); Bharad.'66, pl.3(27); Bharad. & Sriv.'69d, pl.1(21,22), pl.2(1-3).
	Australia . . .	Balme & Henn.'56b, pl.4(42-44).
14	Perth Basin . .	Glick.'72, pl.11(9-11); (Segr.'70,'72).
16	Canning Basin .	Balme'73, pl.3(6), pl.4(8), pl.5(8); (Balme'68).
17	S.Australia . .	(Balme'57; Evans'64b; Har. & Lud.'66; Har. & McG.'68; Doug.'69).
18	Queensland . .	Hill & Woods'63, pl.P15(17); (Evans'67a,c,'66a,b,c,'67a; Pat.'65,69; Burg.'70).
19	Sydney Basin .	(Balme & Henn.'56b; Evans'67b).
20	Tasmania . . .	(Balme & Henn.'56b; Banks'62).





Microbaculispora naumovae (Hart '63) comb. nov.

Verrucosisporites naumovai Hart '63

REFERENCE POPULATION	This paper, pl.57(1-19), 19 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1130' to 1133', L.Ecca equivalent.
HOLOTYPE	Original designation, Hart '63, pl.1(4), p.143.
TYPE LOCALITY	S.Africa, northern Karroo Basin, ± 10 miles due W. of Viljoenskroon. Salisbury borehole, assemblage no.204, 364', L.Ecca equivalent.
NAME DERIVATION	After Dr. S.N. Naumova, palynologist.

DESCRIPTION (ref. pop.)

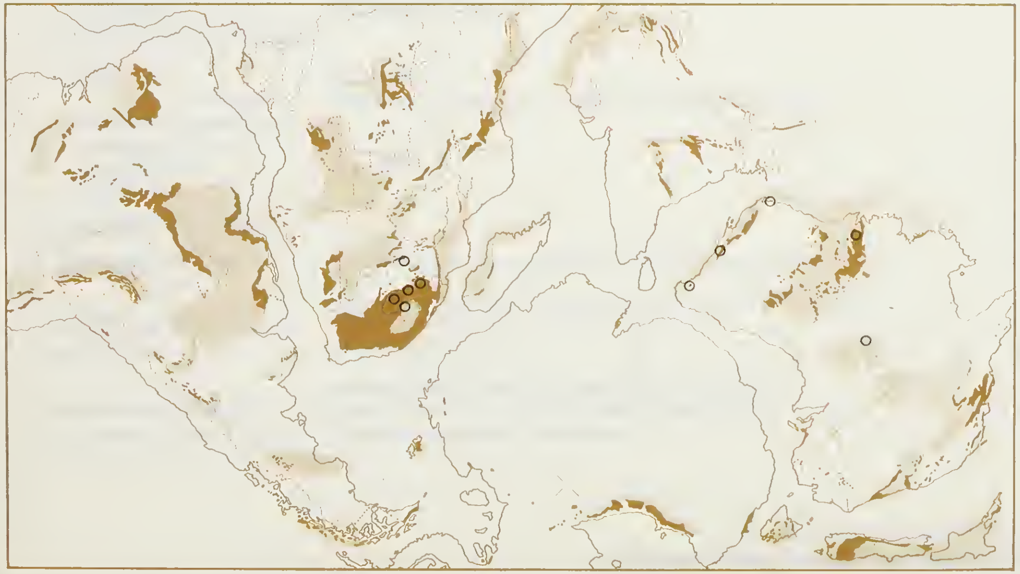
Shape	as for genus
Contact faces	as for genus
Trilete mark	as for genus
Ornament. Arrangement	as for genus
Description	Irregularly intrareticulate to verrucate (elements: 2-3 per 10mu).
Size	64(76)88.

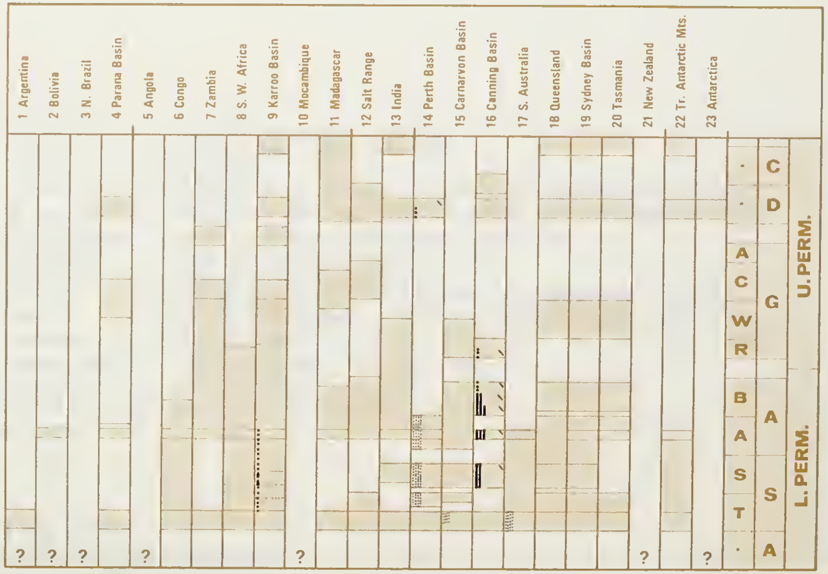
CLOSELY RELATED SPECIES

M.pseudoreticulata	OO; pl.57(4) - pl.56(3).
M.pentagonalis	OO; pl.57(1) - pl.58(5).
M.irregularis	OO ; pl.57(4) - pl.58(22).

LITERATURE

9	Karroo Basin	Hart '63, pl.1(4); This paper, pl.57(1-24); (Hart '66b).
	Australia	Balme '64, pl.3(11).
14	Perth Basin	Segr.'70, pl.3(J,K); Segr.'72, pl.2(7,8); Glick.72, pl.11(10,11).
15	Carnarvon Basin	(Balme '67).
16	Canning Basin	Balme '73, pl.4(7), pl.5(6), pl.7(10); (Balme '68).
17	S.Australia	Evans '64, pl.1(14).





Microbaculispora pentagonalis sp. nov.

REFERENCE POPULATION .	This paper, pl.58(1-3), 3 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Greylingstad/Bethal/Hendrina area. Borehole, UC 621, 153′, M.Ecca.
HOLOTYPE	This paper, pl.58(2).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION . . .	Gr. pente = five; Gr. gony = knee, angle; (ornamentation).

DESCRIPTION (ref. pop.)

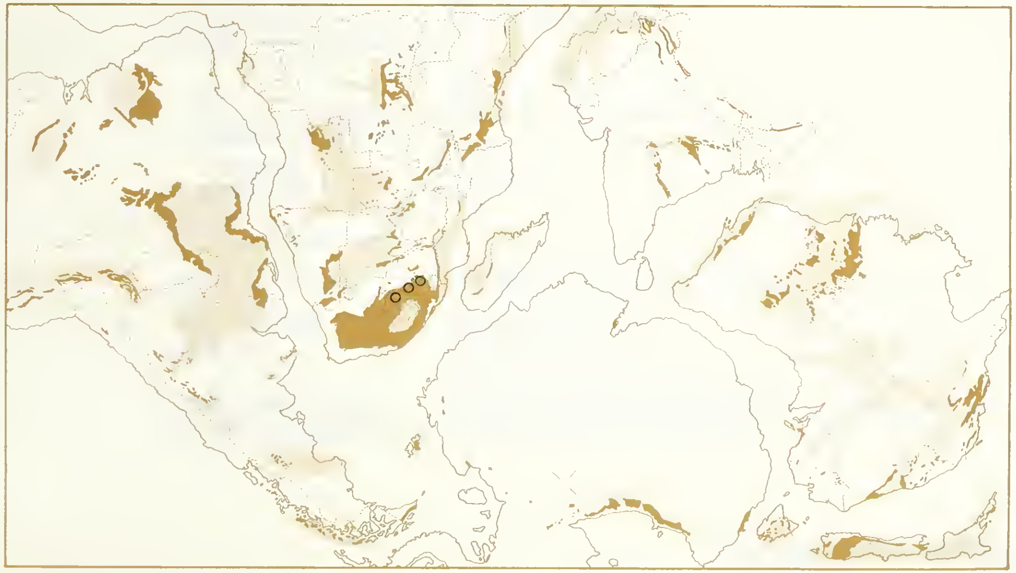
Shape	as for genus.
Contact faces	
Trilete mark	
Ornament. Arrangement .	
Description .	Regularly intrareticulate (the most regular elements are pentagonal).
Size	44(47)50.

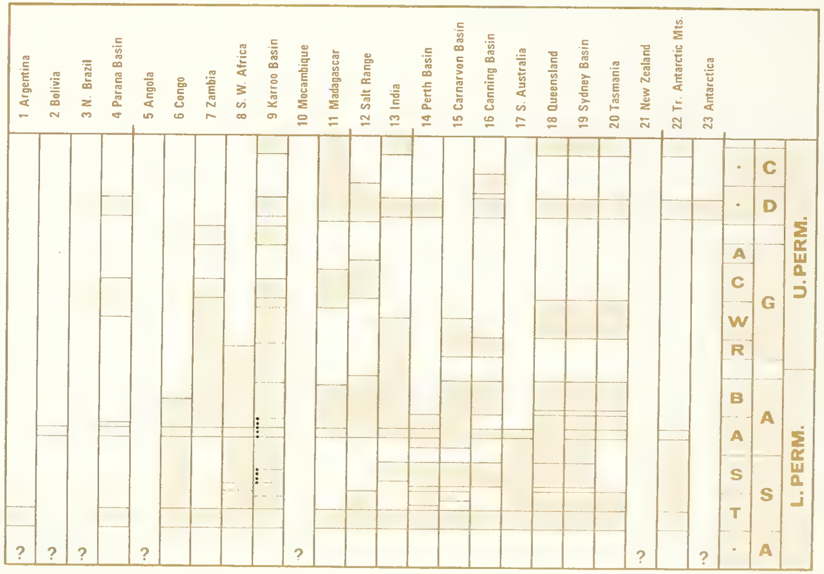
CLOSELY RELATED SPECIES

M.dwykaensis	OO; pl.58(1) - pl.49(40).
M.naumovae	OO; pl.58(5) - pl.57(1).
M.irregularis	Φ ; pl.58(1-3) - pl.58(21-25).

LITERATURE

9	Karroo Basin .	This paper, pl.58(1-7).





Microbaculispora irregularis sp. nov.

REFERENCE POPULATION .	This paper, pl.58(8-16), 9 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Greylingstad/Bethal/Hendrina area. Borehole, UC 678, 79,0 m., M.Ecca.
HOLOTYPE	This paper, pl.58(14).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION . . .	L. irregularis = irregular; (ornamentation).

DESCRIPTION (ref. pop.)

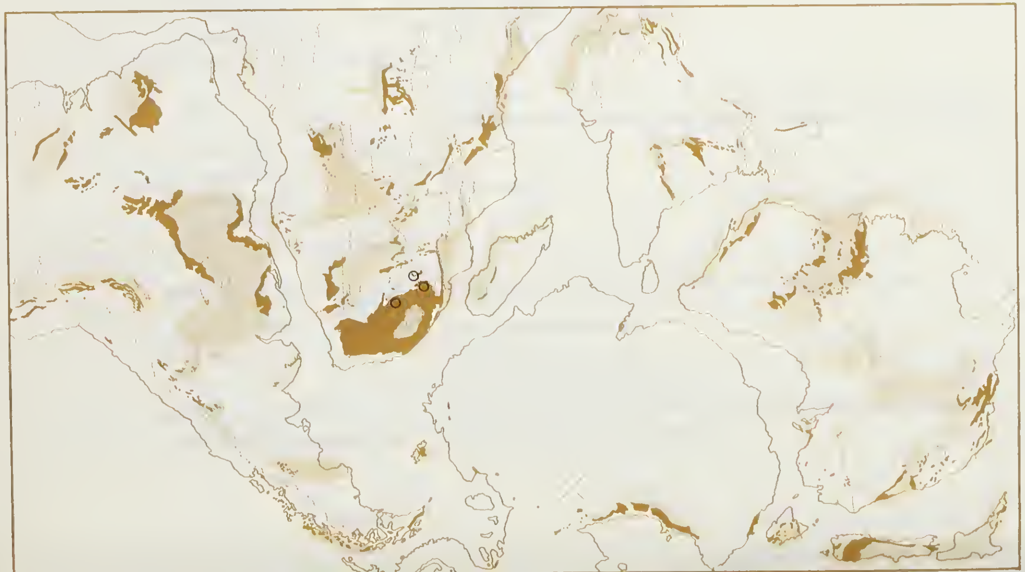
Shape	as for genus.
Contact faces	
Trilete mark	
Ornament. Arrangement .	
Description .	Coarsely, irregularly punctate.
Size	56(65)74.

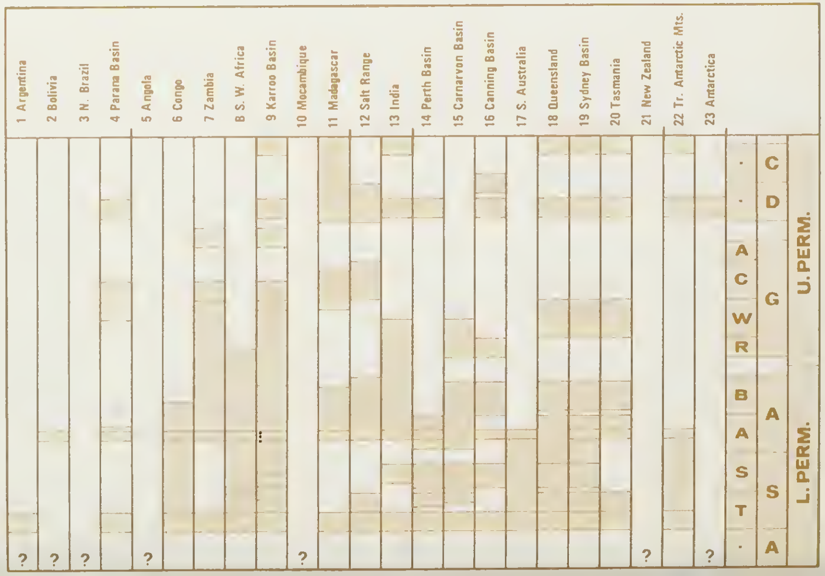
CLOSELY RELATED SPECIES

M.pseudoreticulata . . .	OO; pl.58(22) - pl.56(3).
M.naumovae	ꝏ ; pl.58(22) - pl.57(4).
M. pentagonalis	⦶ ; pl.58(21-25) - pl.58(1-3).

LITERATURE

9	Karroo Basin .	This paper, pl.58(8-25).





Microbaculispora plumsteadi (Hart '63) comb. nov.

Reinchospora plumsteadi Hart '63

REFERENCE POPULATION . This paper, pl.59(1-17), 17 specimens.
REFERENCE LOCALITY . S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1151'3" to 1152'9", L.Ecca equivalent.

HOLOTYPE . . . . . . Original designation, Hart '63, pl.1(9).
TYPE LOCALITY . . . . S.Africa, northern Karroo Basin, ± 10 miles due West of Viljoenskroon. Salisbury borehole, assemblage no.202, 354', L.Ecca equivalent.

NAME DERIVATION . . . After Dr. E.Plumstead, palaeobotanist.

DESCRIPTION (ref. pop.)
Shape . . . .
Contact faces . . . .
Trilete mark . . . . .
Ornament. Arrangement
as for genus.
Description . Levigate to indistinctly granulate, with 2 rows of grana approximately along outer margin of contact faces.
Size . . . . 34(39)44.

CLOSELY RELATED SPECIES

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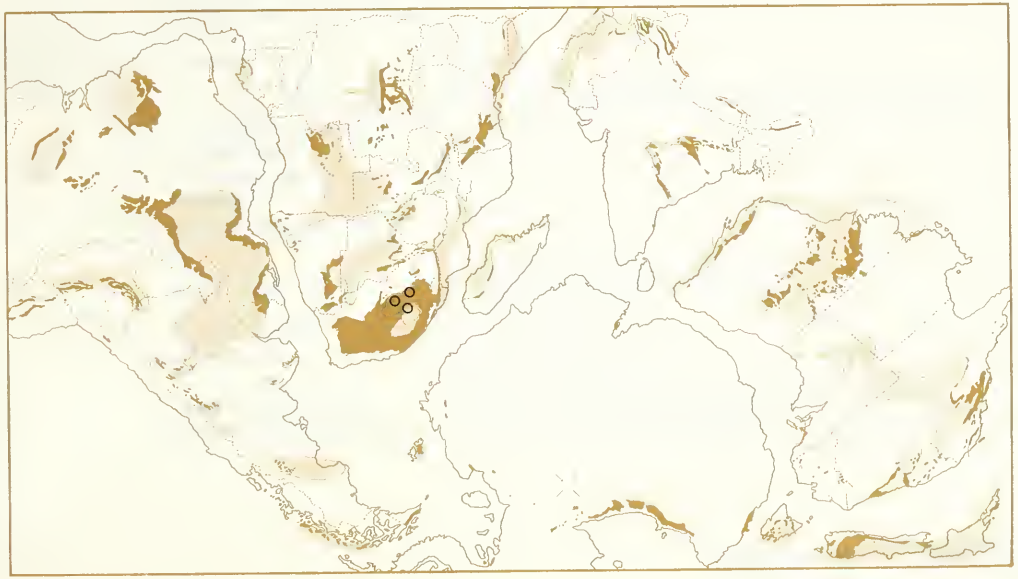
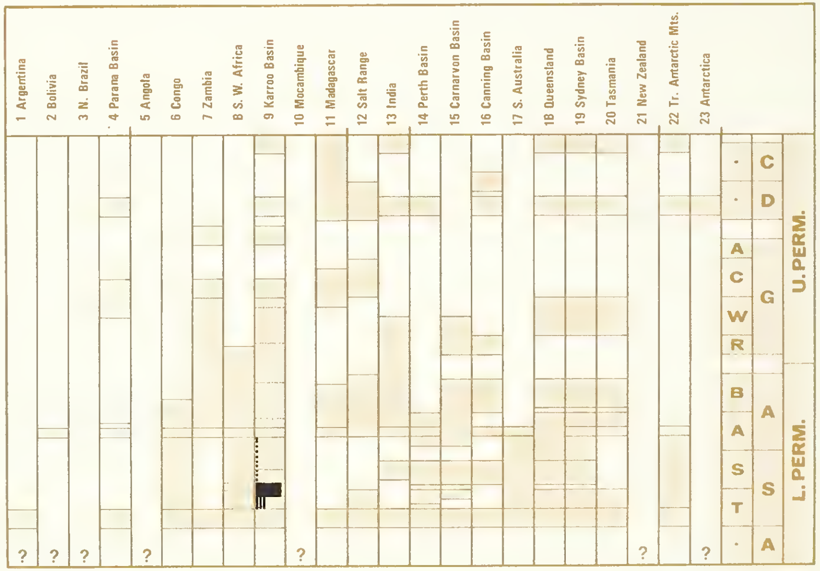
LITERATURE
9 Karroo Basin . Hart '63, pl.1(7); This paper, pl.59(1-25).





Microbaculispora lageniformis sp. nov.

REFERENCE POPULATION .	This paper, pl.59(35-40), 6 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, OW 1257', M.Ecca.
HOLOTYPE	This paper, pl.59(40).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION . . .	L. lagena = bottle; L. forma = form, shape; (ornamentation bordering contact faces).

DESCRIPTION (ref. pop.)

Shape	as for genus.
Contact faces	as for genus.
Trilete mark	as for genus.
Ornament. Arrangement	as for genus.
Description .	Levigate, with 2 rows of bottle-shaped spines approximately along outer margin of contact faces.
Size	40(45) 50.

CLOSELY RELATED SPECIES

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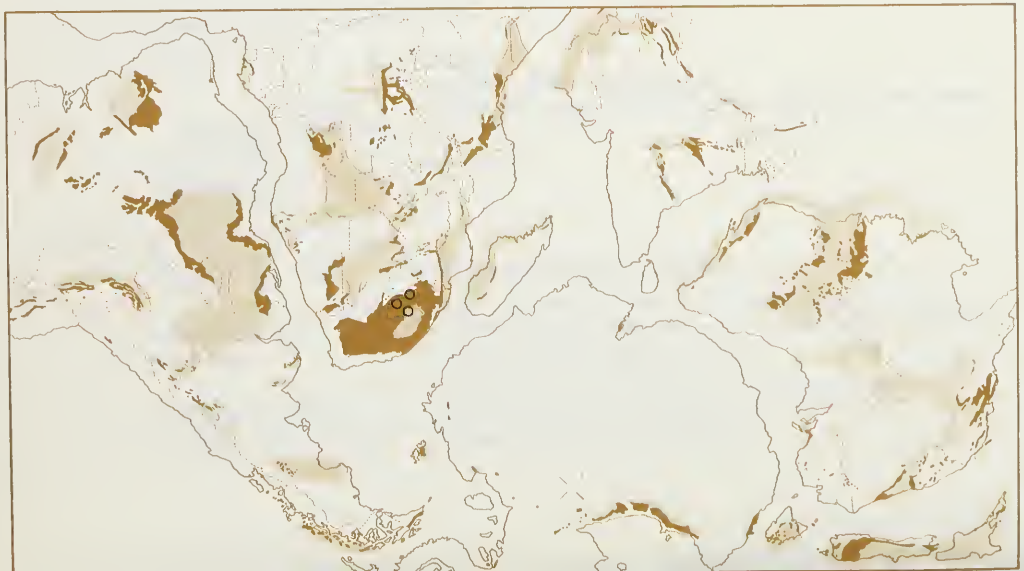
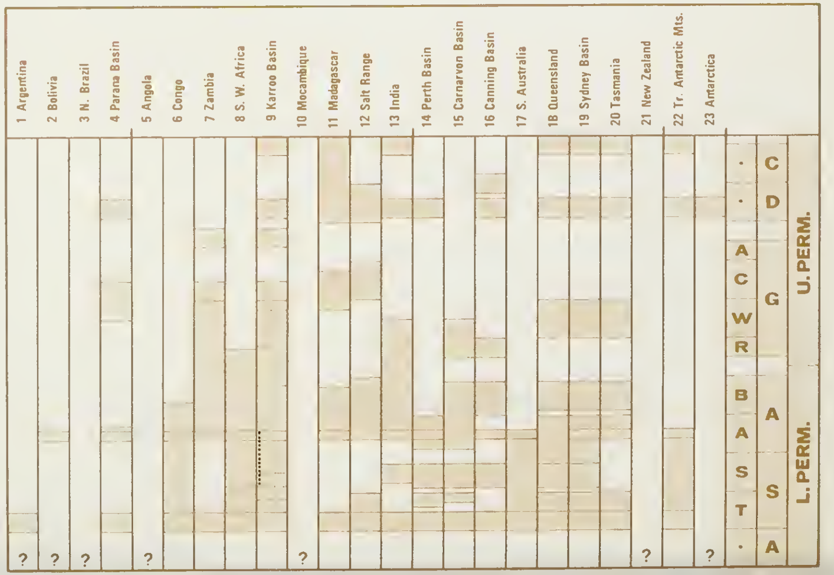
LITERATURE

9	Karroo Basin .	This paper, pl.59(26-42).





Microbaculispora paramicronodosa sp. nov.

REFERENCE POPULATION . This paper, pl.60(1-6), 5 specimens.
REFERENCE LOCALITY . S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1131′ to 1133′, L.Ecca equivalent.

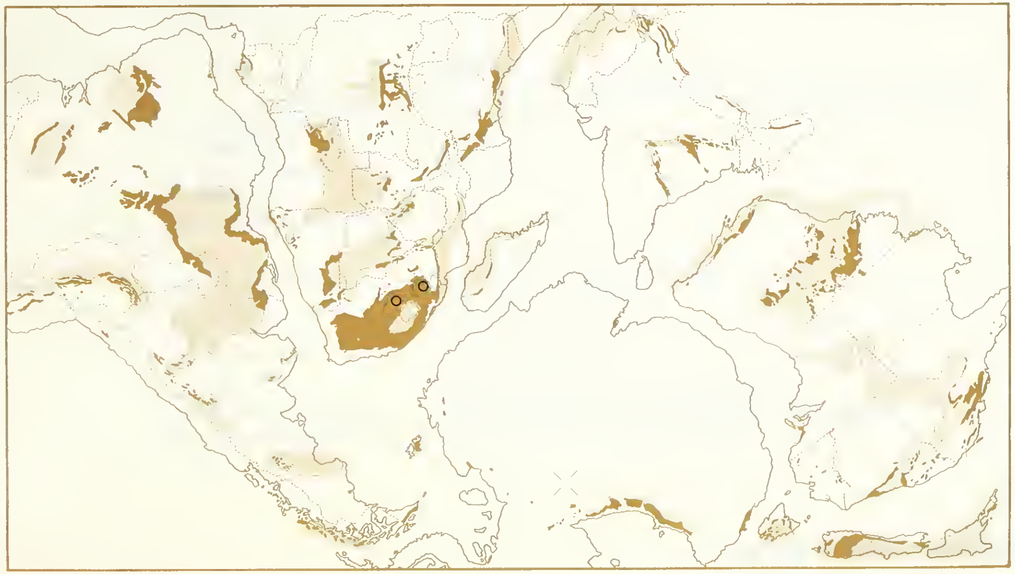
HOLOTYPE . . . . . . This paper, pl.60(2).
TYPE LOCALITY . . . . As for reference locality.

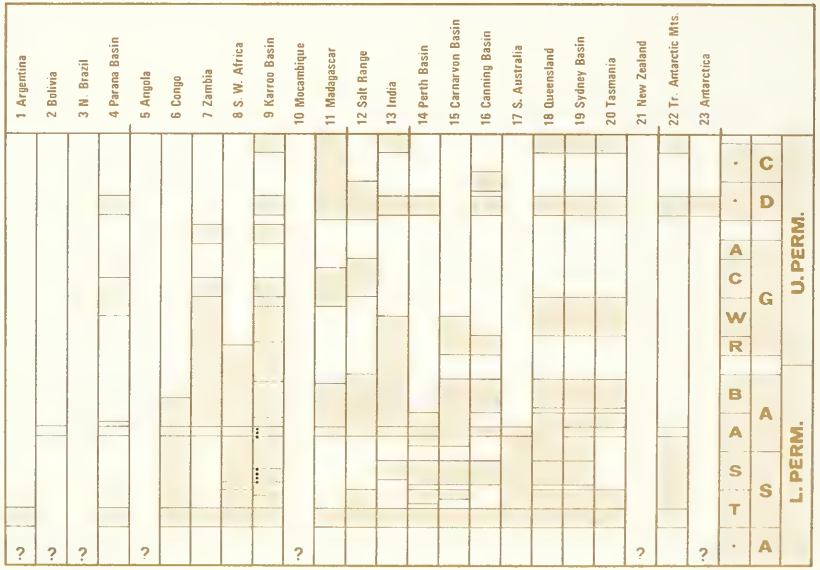
NAME DERIVATION . . . Gr. para- = near, like; Gr. mikros = small; L. nodosa = knotty; (probably derived from *M.micronodosa*).

DESCRIPTION (ref. pop.)
Shape . . . . as for genus.
Contact faces . . . . as for genus.
Trilete mark . . . . . as for genus.
Ornament. Arrangement . as for genus.
Description . Papillate, with a single row of enlarged grana approximately along outer margin of contact faces.
Size . . . . 36(44)52.

CLOSELY RELATED SPECIES
M.micronodosa . . . . $\underline{\Phi}$; pl.60(1-6) - pl.50(24-30).

LITERATURE
9 Karroo Basin . This paper, pl.60(1-9).





Microbaculispora paratentula sp. nov.

REFERENCE POPULATION .	This paper, pl.60(10-17), 8 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, OW 1156', M.Ecca equivalent.
HOLOTYPE	This paper, pl.60(14).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION . . .	Gr. para- = near, like; L. tentorium = tent; (probably derived from *M.tentula*).

DESCRIPTION (ref. pop.)

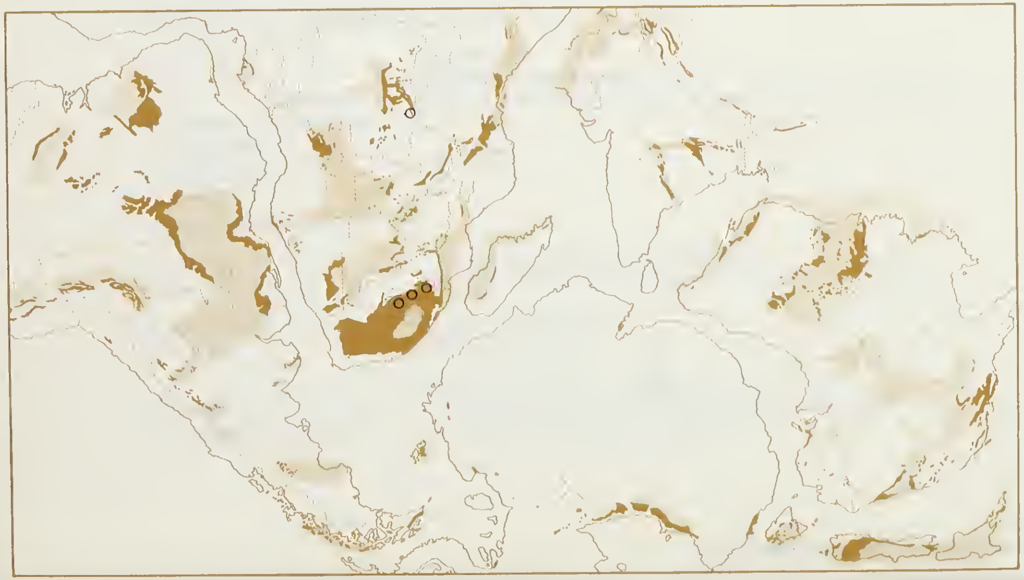
Shape	as for genus.
Contact faces	as for genus.
Trilete mark	as for genus.
Ornament. Arrangement .	as for genus.
Description .	Finely granulate with a single row of enlarged grana approximately along outer margin of contact faces.
Size	26(33)40.

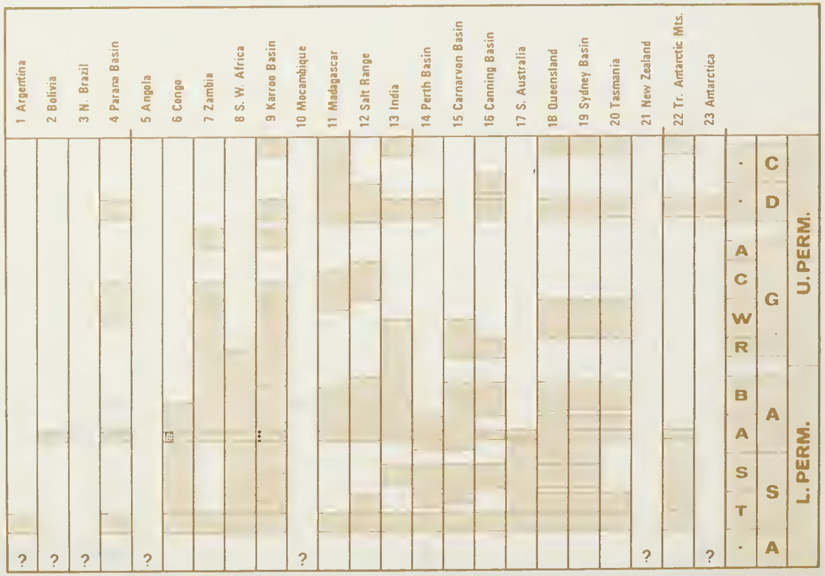
CLOSELY RELATED SPECIES

M.tentula	OO; pl.60(13) - pl.48(5).

LITERATURE

6	Congo . . .	Mahesh. & Bose'69, pl.2(21).
9	Karroo Basin .	This paper, pl.60(10-28).





Microbaculispora spinosa sp. nov.

REFERENCE POPULATION .	This paper, pl.60(29-32), 4 specimens.
REFERENCE LOCALITY .	S.Africa, central Transvaal, Springbok Flats. Surface locality, HKr, M.Ecca.
HOLOTYPE	This paper, pl.60(29a).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION . . .	L. spinosa = thorny, spiny; (ornamentation bordering contact faces).

DESCRIPTION (ref. pop.)

Shape	as for genus.
Contact faces	as for genus.
Trilete mark	as for genus.
Ornament. Arrangement .	as for genus.
Description .	Spinate with a single row of spines approximatley along outer margin of contact faces.
Size	34(35) 36.

CLOSELY RELATED SPECIES

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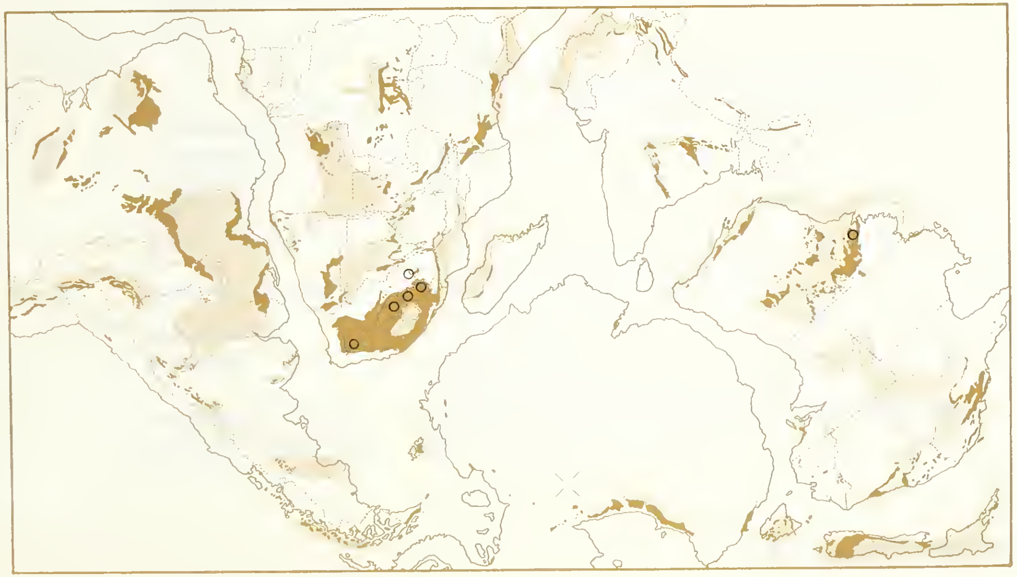
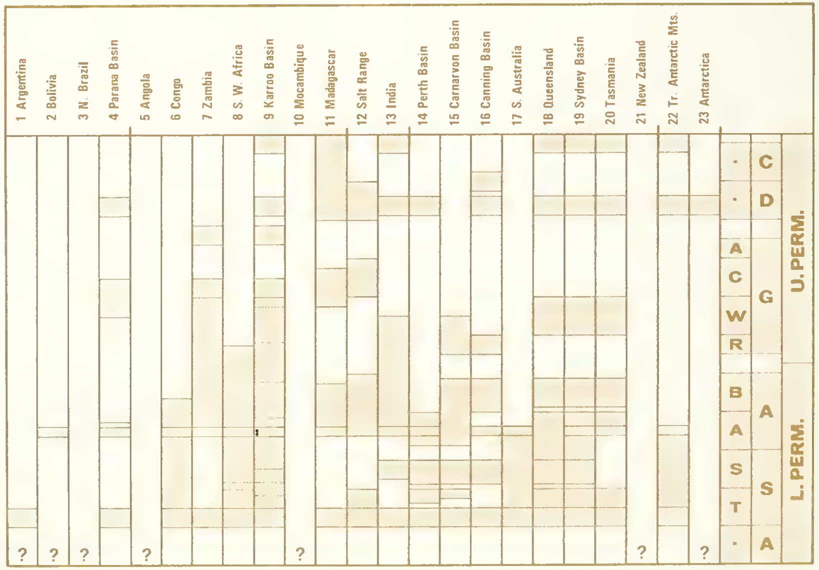
LITERATURE

9	Karroo Basin .	This paper, pl.60(29-40).
16	Canning Basin .	Balme'73, pl.3(3).





Microbaculispora capilliformis sp. nov.

REFERENCE POPULATION .	This paper, pl.60(41-44), 4 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Greylingstad/Bethal/Hendrina area. Borehole, UC 621, 153', M.Ecca.
HOLOTYPE	This paper, pl.60(43).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION . . .	L. capillus = hair; L. forma = form, shape; (ornamentation bordering contact faces).

DESCRIPTION (ref. pop.)

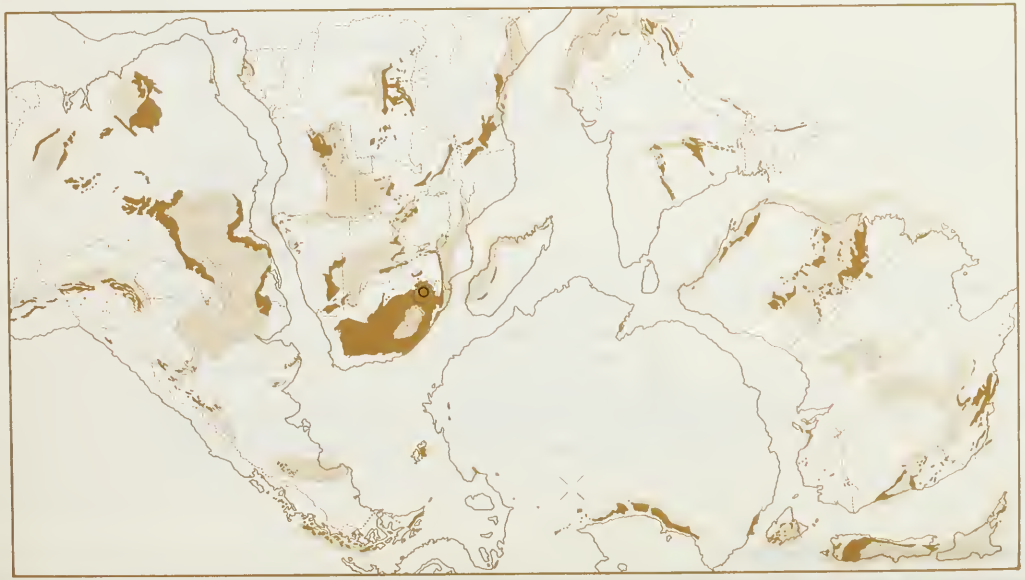
Shape	as for genus.
Contact faces	
Trilete mark	
Ornament. Arrangement .	
Description . .	Levigate to very indistinctly granulate with a single row of hair-like setae (13 per 10mu) approximately along outer margin of contact faces.
Size	30(36)42.

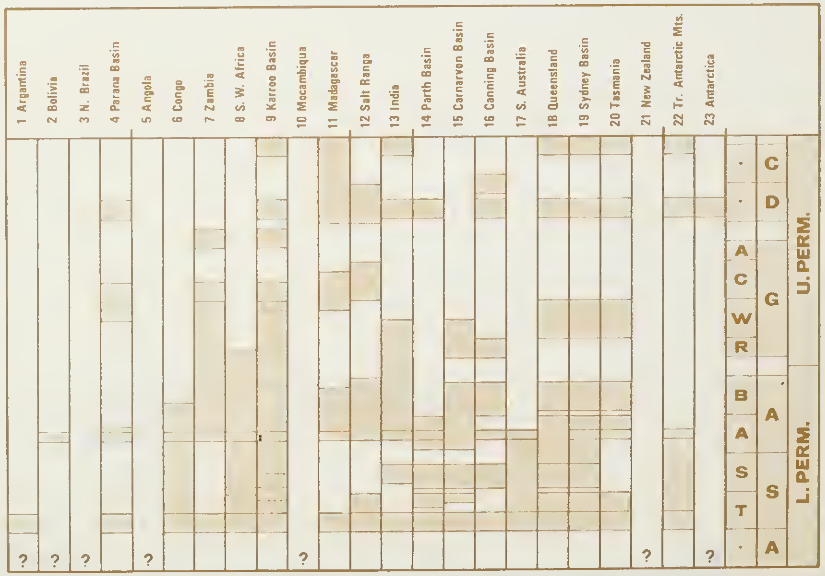
CLOSELY RELATED SPECIES

M.digitiformis . . . . OO; pl.60(41) - pl.60(46).

LITERATURE

9 Karroo Basin . This paper, pl.60(41-44).





Microbaculispora digitiformis sp. nov.

REFERENCE POPULATION .	This paper, pl.60(45-47), 3 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Standerton area. Borehole, UC 608, 1262', Dwyka Tillite.
HOLOTYPE	This paper, pl.60(47).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION . . .	L. digitus = finger; L. forma = form, shape; (ornamentation bordering contact faces).

DESCRIPTION (ref. pop.)

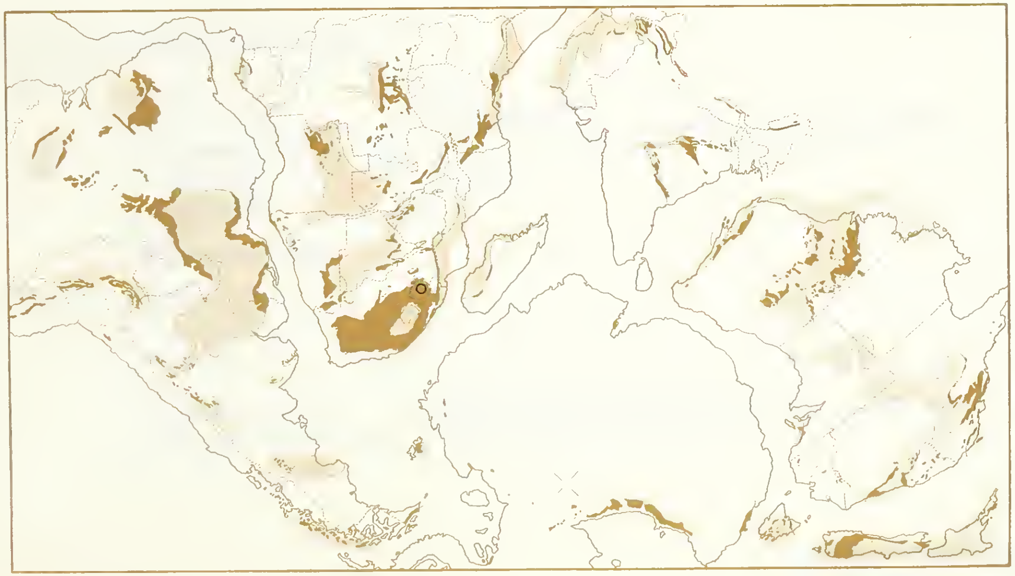
Shape	as for genus.
Contact faces	as for genus.
Trilete mark	as for genus.
Ornament. Arrangement .	as for genus.
Description .	Levigate to indistinctly granulate with a single row of elongate baculae (7 per 10mu) approximately along outer margin of contact faces.
Size	34 (36) 38.

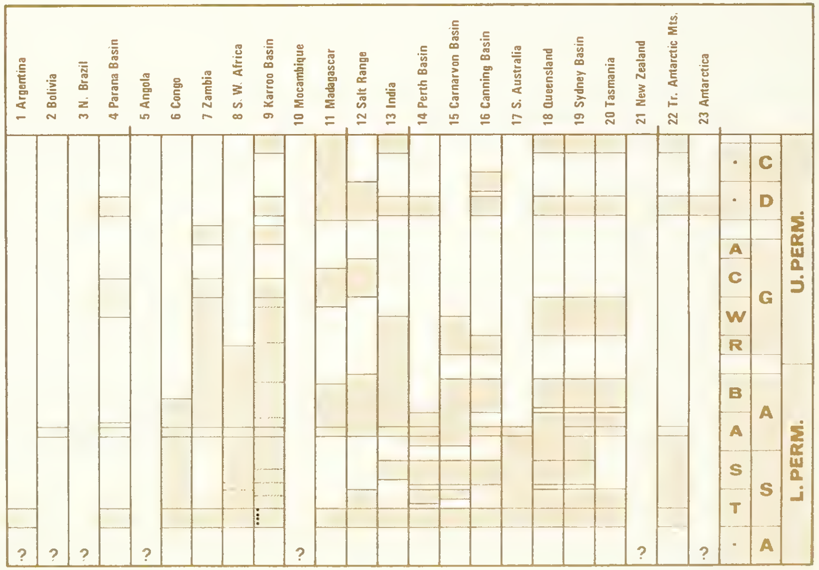
CLOSELY RELATED SPECIES

M.capilliformis . . . . $\underline{OO}$; pl.60(46) - pl.60(41).

LITERATURE

9 Karroo Basin . This paper, pl.60(45-47).





Microbaculispora sp.A.

REFERENCE POPULATION . This paper, pl.60(48-49), 1 specimen.
REFERENCE LOCALITY . S.Africa, northern Karroo Basin, Greylingstad/Bethal/Hendrina area. Borehole, UC 678, 31,6m., M.Ecca.

HOLOTYPE . . . . —
TYPE LOCALITY . . . . —

NAME DERIVATION . . . —

DESCRIPTION (ref. pop.)
Shape . . . . ⎤
Contact faces . . . . . ⎥ as for genus.
Trilete mark . . . . . ⎥
Ornament. Arrangement . ⎦
Description . Granulate with 2 rows of enlarged grana approximately along outer margin of contact faces.
Size . . . . —(54)—.

CLOSELY RELATED SPECIES
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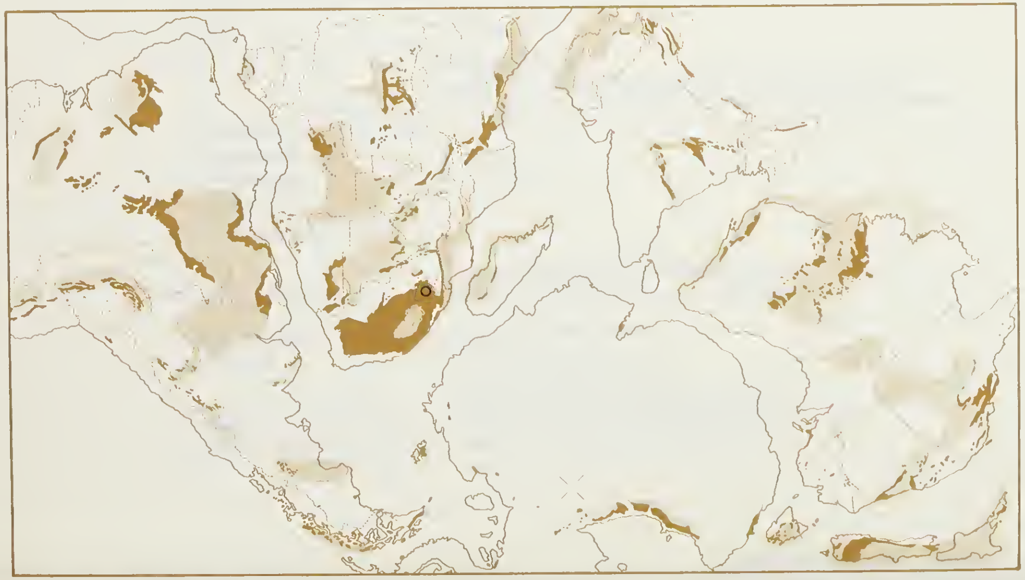
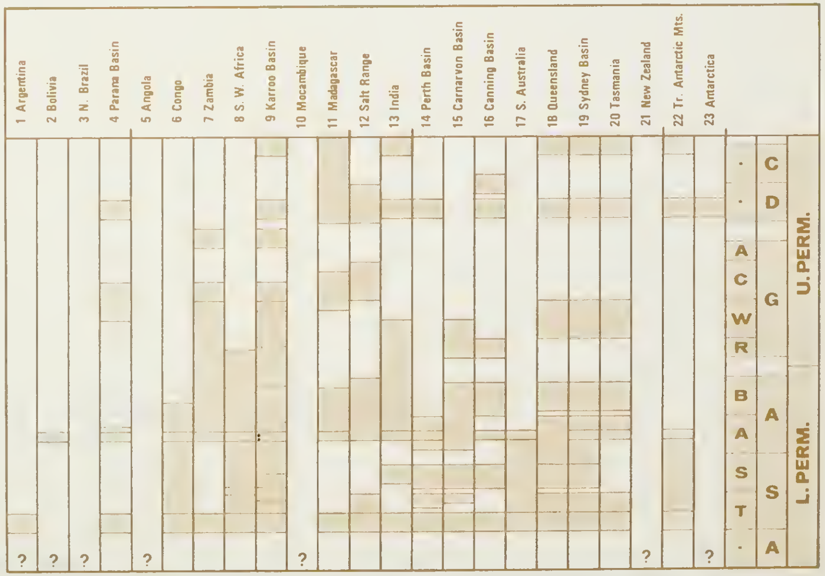
LITERATURE
9 Karroo Basin . This paper, pl.60(48,49).





Gracilispora membranosa gen. et. sp. nov.

REFERENCE POPULATION . This paper, pl.61(1-12), 13 specimens.
REFERENCE LOCALITY . S.Africa, central Transvaal, Springbok Flats. Surface locality, HKr., M.Ecca.

HOLOTYPE . . . . . . This paper, pl.61(9).
TYPE LOCALITY . . . . As for reference locality.

NAME DERIVATION . . . L. membranosa = membrane; (membranous exoexine).

DESCRIPTION (ref. pop.) . . as for genus.

CLOSELY RELATED SPECIES

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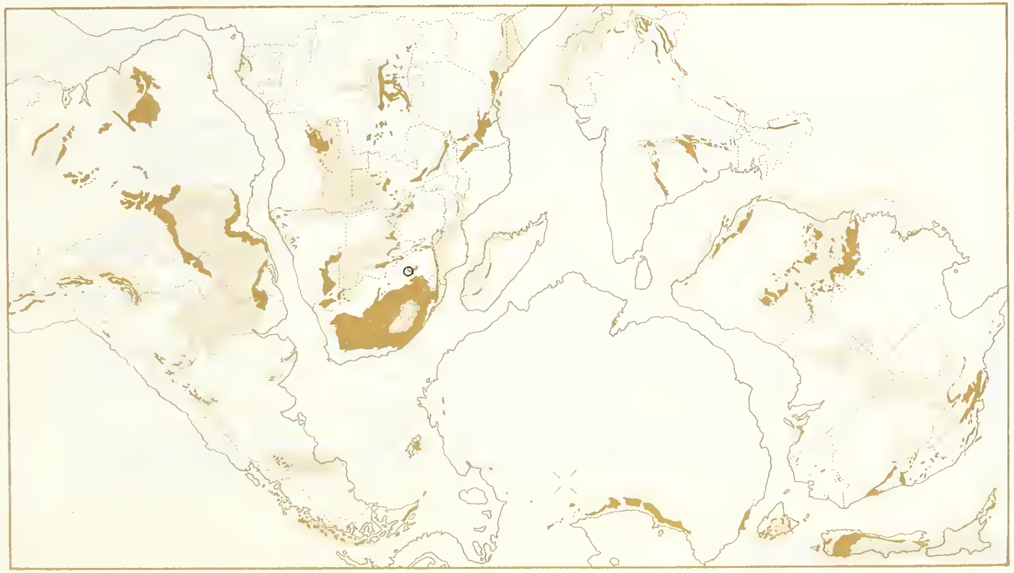
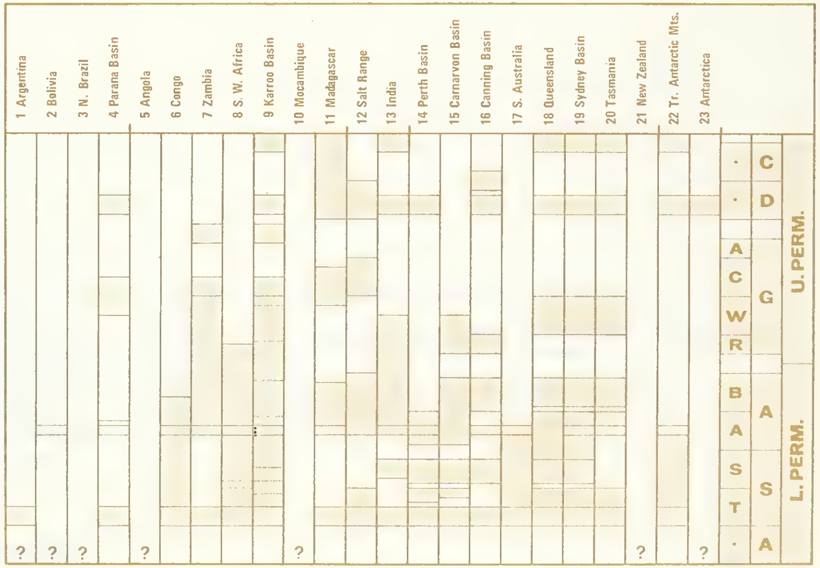
LITERATURE

9 Karroo Basin . This paper, pl.61(1-12).





Dulhuntyispora dulhuntyi Pot.'56

REFERENCE POPULATION . This paper, pl.62(1-5), 5 specimens.

REFERENCE LOCALITY . S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 7, 464', U.Ecca.

HOLOTYPE . . . . Designated by Potonié'56; Dulh.'45, pl.7(21A), p.155.

TYPE LOCALITY . . . . N.S.W., Sydney Basin
? locality, Kamilaroi Coal Measures (Upper Permian).

NAME DERIVATION . . . After J.A. Dulhunty, palynologist.

DESCRIPTION (ref. pop.)

- **Shape** . . . .] as for genus.
- **Contact faces** . . . .] as for genus.
- **Trilete mark** . . . . .] as for genus.
- **Inter-radial blisters** . . . Basal diameter ½ diameter of spore.
- **Ornamentation** . . . . Fine reticulum merging into a series of ridges radiating out from and originating on the blisters.
- **Size** . . . . 94(114)134.

CLOSELY RELATED SPECIES

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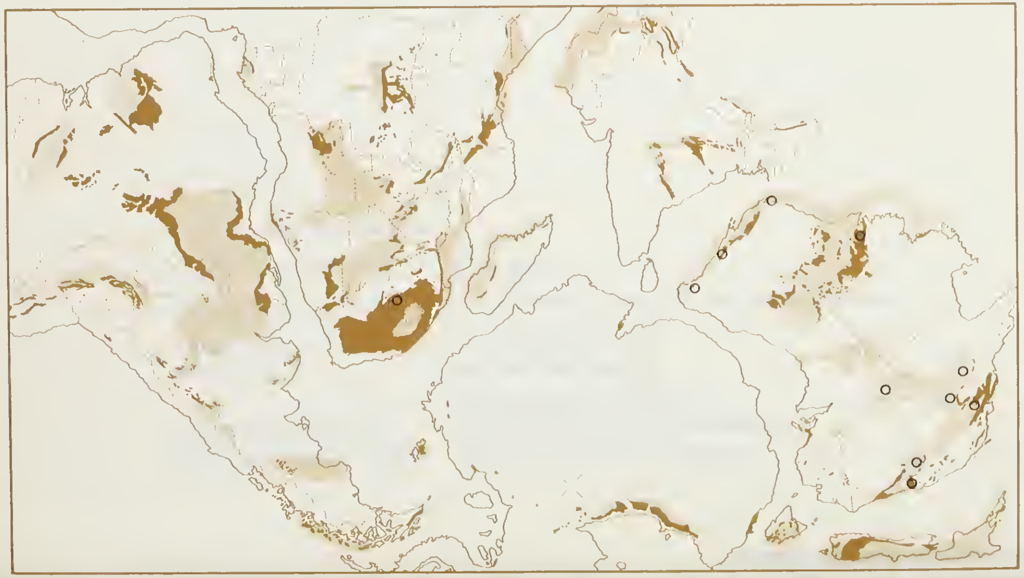
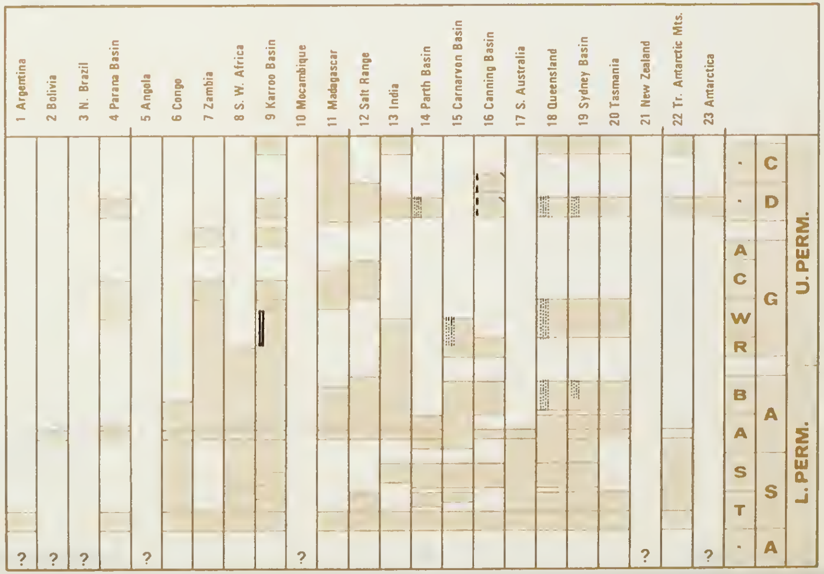
LITERATURE

9	Karroo Basin .	This paper, pl.62(1-7).
	Australia . . .	Balme & Henn.'56b, pl.9(72-75); Balme'64, pl.4(5).
14	Perth Basin . .	Segr.'70, pl.7(A-C); Segr.'72, pl. 6(6); Glick.'72, pl.15(1-4).
15	Carnarvon Basin .	(Balme'67).
16	Canning Basin .	Balme'73, pl.2(19); (Balme & Henn.'56b; Balme'68).
18	Queensland . .	Hill & Woods'63, pl.15(13); (Evans'64a,c,'66a,b,c,'67a; Pat.'65,'69; Rig.'73).
19	Sydney Basin .	Dulh.'45, pl.7(21A); (Balme & Henn.'56b; Evans'67b).





Pachytriletes densus Bose & Kar '66

REFERENCE POPULATION .	This paper, pl.63(1-31), 31 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Standerton area. Borehole, UC 608, 1262', Dwyka Tillite.
HOLOTYPE	Original designation, Bose & Kar '66, pl.19(11), p.65.
TYPE LOCALITY	Congo, Walikale region. Surface locality, Mabuita, Assise des schistes noirs de Walikale.
NAME DERIVATION . . .	L. densus = dense; (general appearance).
DESCRIPTION (ref. pop.) . .	as for genus.

CLOSELY RELATED SPECIES

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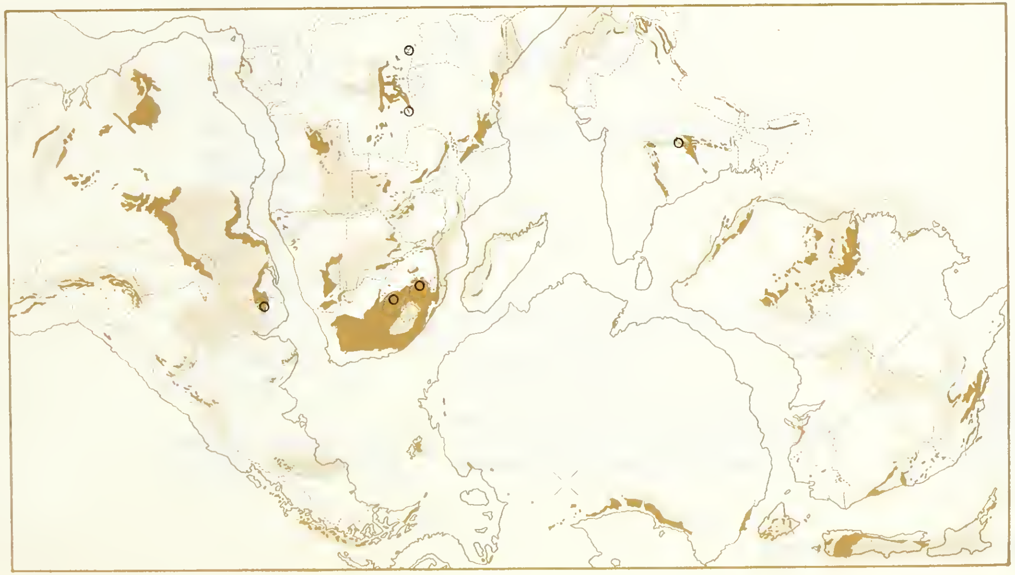
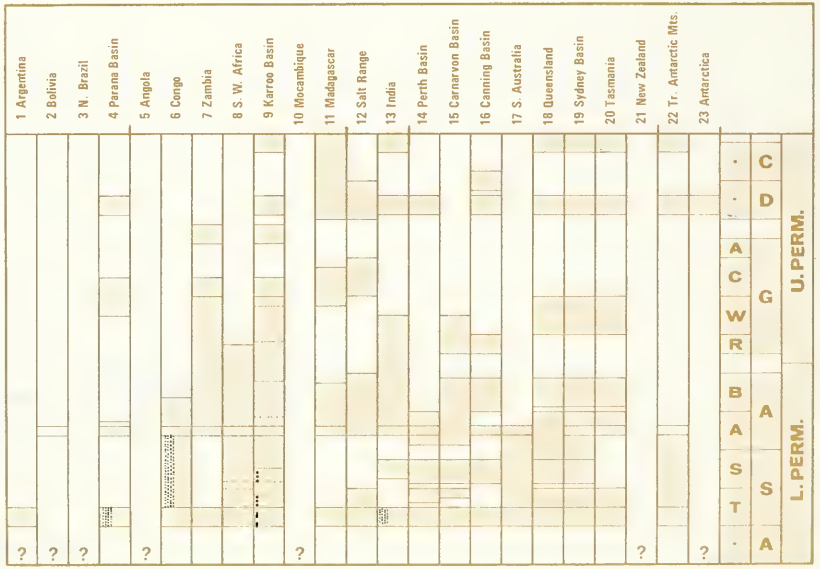
LITERATURE

4	Parana Basin . .	Bharad.'69, pl.1(2).
6	Congo . . .	Bose & Kar '66, pl.19(11-13); Kar & Bose'67, pl.1(1,2), pl.2(10), pl.3(4).
9	Karroo Basin .	This paper, pl.'63(1-31).
13	India	Pot. & Lele'61, pl.1(4,5); Saks.'71, pl.2(24).





Punctatisporites gracilis sp. nov.

REFERENCE POPULATION	This paper, pl.64(1-24), 24 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Standerton area. Borehole, UC 608, 1590', Dwyka Tillite.
HOLOTYPE	This paper, pl.64(7).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION	L. gracilis = gracile, delicate; (general appearance).

DESCRIPTION (ref. pop.)

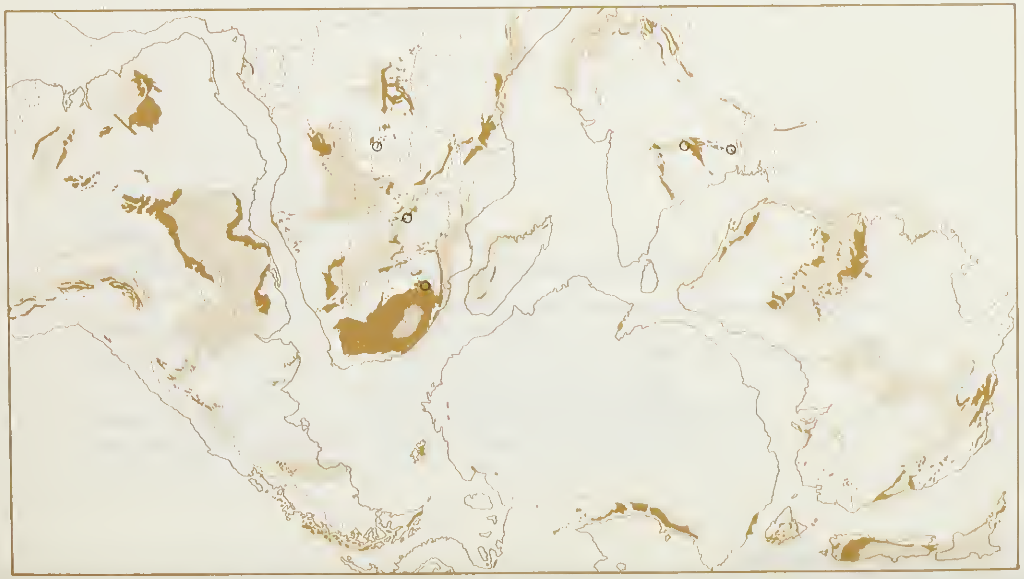
Shape	as for genus.
Contact faces	as for genus.
Trilete mark	as for genus.
Ornamentation	as for genus.
Size	48(54) 74.
Exine thickness	⅔ mu (with a strong tendency to folding).

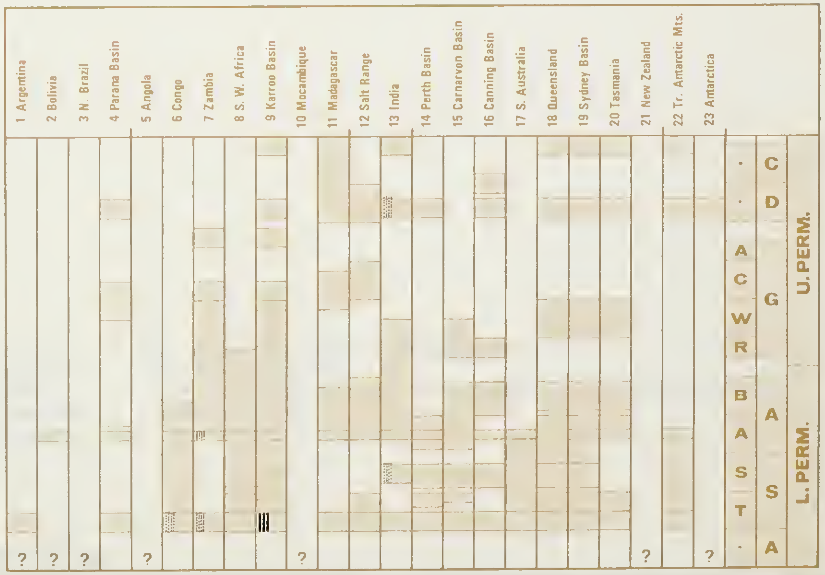
CLOSELY RELATED SPECIES

P.medius	OO; pl.64(2) - pl.65(31).
P.gretensis	OO; pl.64(2) - pl.66(1).

LITERATURE

6	Congo	Mahesh.69, pl.1(3).
7	Zambia	Falc.'72, pl.1(10,11).
9	Karroo Basin	This paper, pl.64(1-24).
13	India	Bharad. & Sal.'65a, pl.1(2-4); Lele & Maithy'69, pl.1(2).





Punctatisporites parvus sp. nov.

REFERENCE POPULATION	This paper, pl.65(1-7), 7 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Standerton area. Borehole, UC 608, 1262', Dwyka Tillite.
HOLOTYPE	This paper, pl.65(6).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION	L. parvus = small; (general size).

DESCRIPTION (ref. pop.)

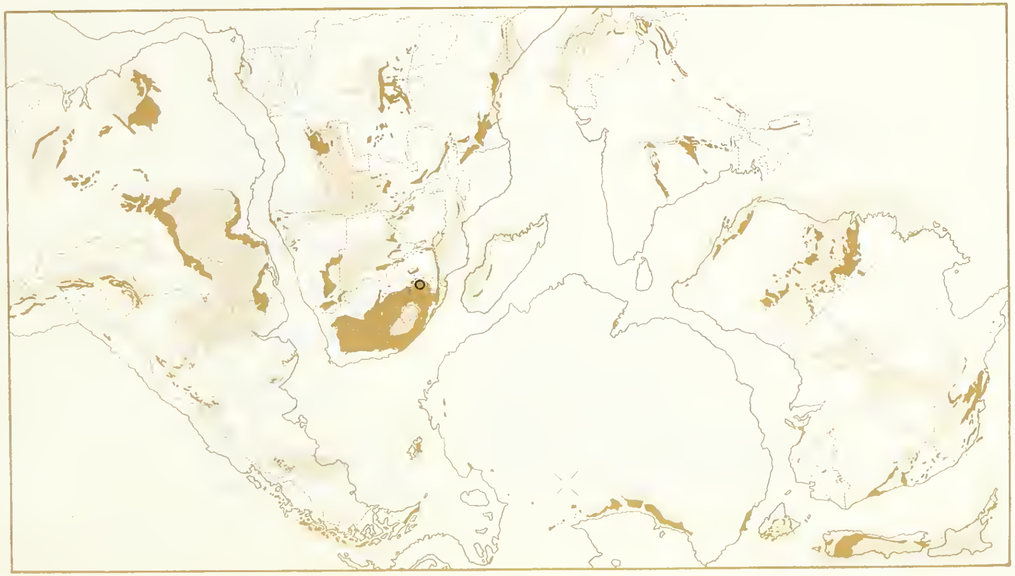
Shape	as for genus.
Contact faces	as for genus.
Trilete mark	as for genus.
Ornamentation	as for genus.
Size	28(32)36.
Exine thickness	1 mu (with very little or no tendency to folding).

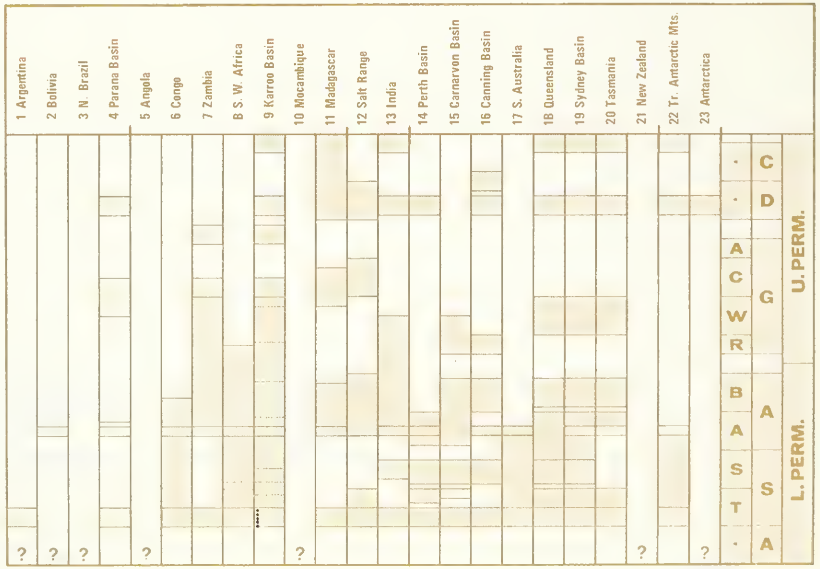
CLOSELY RELATED SPECIES

P.medius *P.gretensis*	Ⓥ; pl.65(1-7) - pl.65(8-22).

LITERATURE

9	Karroo Basin	This paper, pl.65(1-7).





Punctatisporites medius sp. nov.

REFERENCE POPULATION	This paper, pl.65(26-31), 6 specimens.
REFERENCE LOCALITY	S.Africa, central Transvaal, Springbok Flats. Surface locality, HKr., M.Ecca.
HOLOTYPE	This paper, pl.65(27).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION	L. medius = medium; (general size).

DESCRIPTION (ref. pop.)

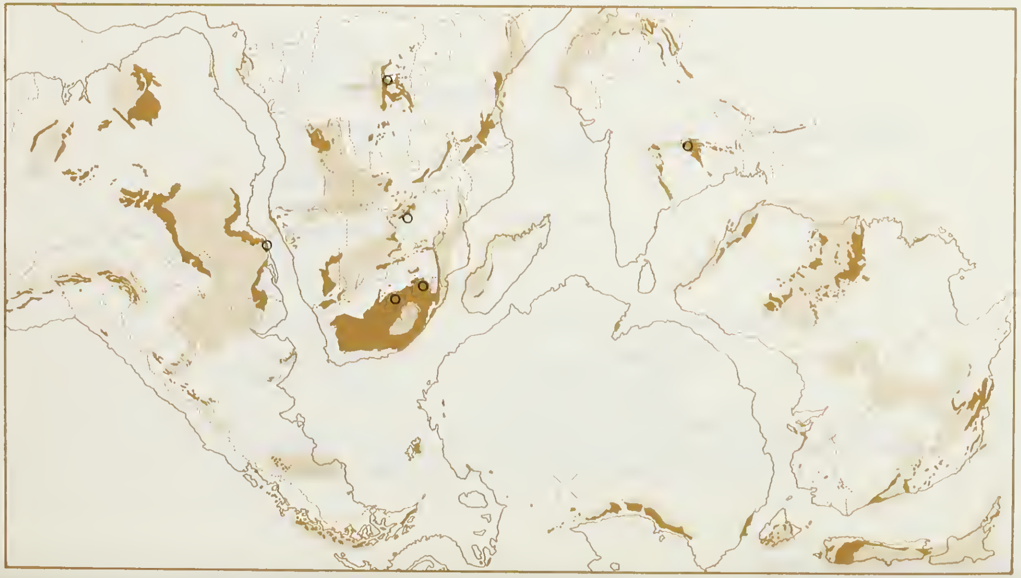
Shape	as for genus
Contact faces	
Trilete mark	
Ornamentation	
Size	40 (43) 46.
Exine thickness	3mu (with very little or no tendency to folding).

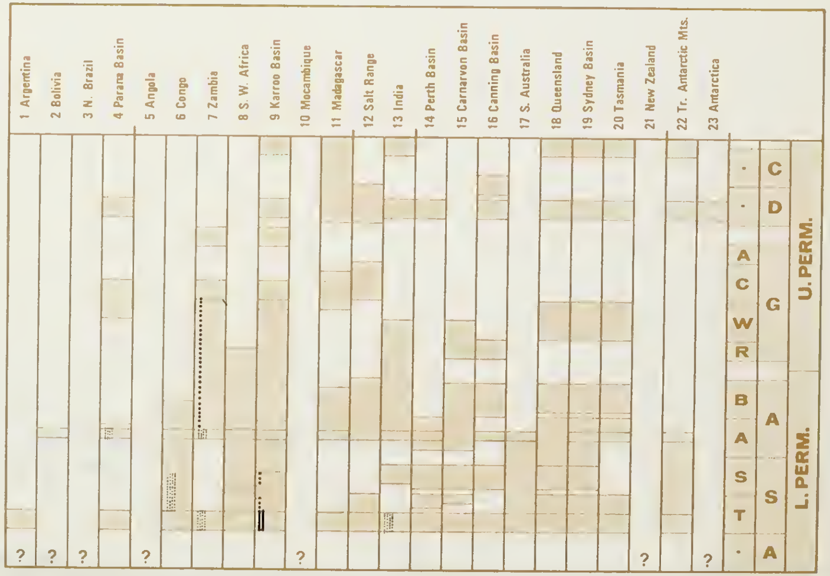
CLOSELY RELATED SPECIES

P.gracilis	OO; pl.65(31) - pl.64(2).
P.parvus *P.gretensis*	Ⓨ; pl.65(8,9) - pl.65(1-7,10-22).

LITERATURE

4	Parana Basin	Pant. & Sriv.'65, pl.1(12).
6	Congo	Bose & Kar'66, pl.30(2-4).
7	Zambia	Falc.'72, pl.1(2-6).
9	Karroo Basin	This paper, pl.65(8,9,26-31).
13	India	Pot. & Lele'61, pl.1(8).





Punctatisporites gretensis Balme & Henn.'56

REFERENCE POPULATION	This paper, pl.66(1-19), 19 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1130', L.Ecca equivalent.
HOLOTYPE	Not designated to date.
TYPE LOCALITY	N.S.W., Sydney Basin. Hebburn No.2 Colliery, Main Greta seam, Greta Coal Measures.
NAME DERIVATION	After Greta Coal Measures, N.S.W.

DESCRIPTION (ref. pop.)

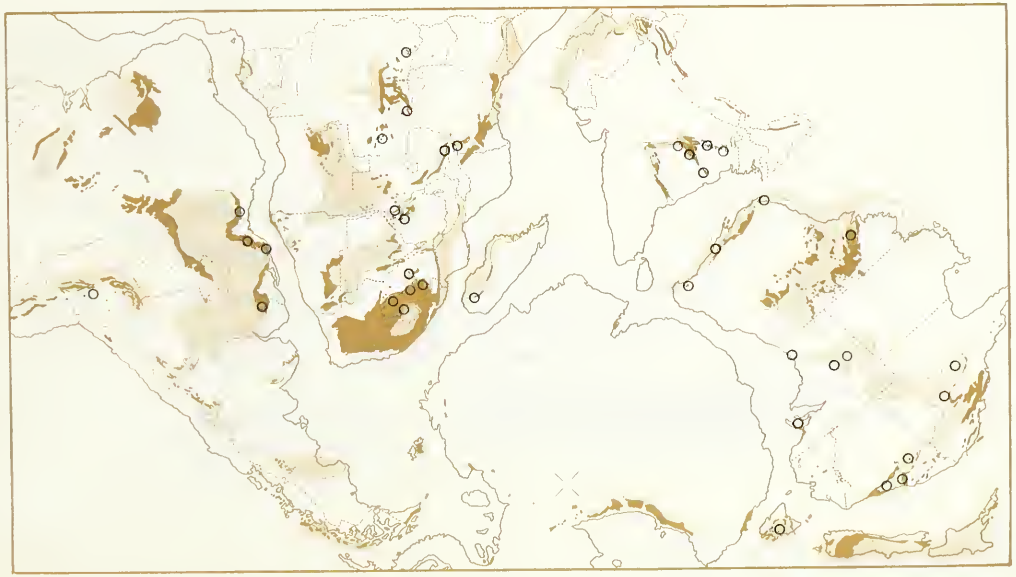
Shape	as for genus.
Contact faces	as for genus.
Trilete mark	as for genus.
Ornamentation	as for genus.
Size	52(73)94.
Exine thickness	2mu (with very little or no tendency to folding).

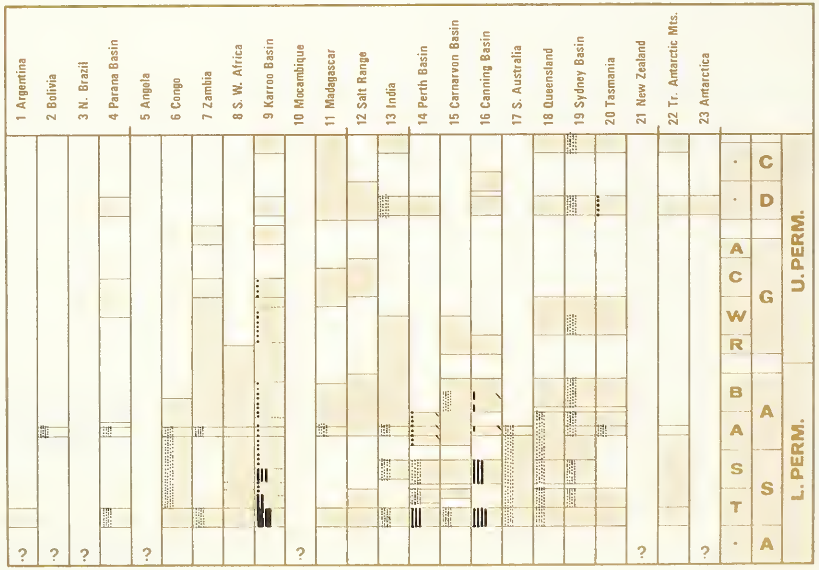
CLOSELY RELATED SPECIES

P.gracilis	O̲O̲; pl.66(1) - pl.64(2).
P.parvus *P.medius*	⊖̲ ; pl.65(10-22) - pl.65(1-9).

LITERATURE

2	Bolivia	Cousm.'65, pl.127(5).
4	Parana Basin	Pant. & Sriv.'65, pl.1(13); Tiw. & Nav.'67, pl.1(1); Bharad.'69, pl.1(5,6); Kemp (in press), pl.1(14).
6	Congo	Pier.'59, pl.8(3); Hoeg & Bose'60, pl.27(1,2), pl.31(2); Bose & Kar'66, pl.18(3-5), pl.30(5,21,22); Kar & Bose'67, pl.1(8); Bose & Mahesh.'68, pl.3(4-6,8-10).
7	Zambia	Hart'60, pl.1(16); Hart'63b, pl.1(10); Falc.'72, pl.1(1); (Utt.'70).
9	Karroo Basin	This paper, pl.65(10-25), pl.66(1-19).
11	Madagascar	Rakoto.'70, pl.4(1-4,8-12).
13	India	Pot. & Lele'61, pl.1(7); Bharad.'62, pl.1(8); Bharad. & Tiw.'64b, pl.1(1,4); Tiw.'65, pl.1(5); Maithy'66, pl.1(8); Nav.'66, pl.2(17,18); Bharad. & Tiw.'66, pl.1(4); Nav. & Tiw.'66, pl.1(6-8); Nav. & Tiw.'67, pl.8(3); Tiw.'68, pl.1(2-5); Bharad. & Sriv.'69d, pl.1(1-6); Saks.'71, pl.1(8,9); Sinha'72, pl.1(3,5).
	Australia	Balme & Henn.'56b, pl.2(11-13); Balme'64, pl.3(10).
14	Perth Basin	Segr.'70, pl.1(G); Segr.'72, pl.1(5), pl.2(9); Glick.'72, pl.6(5-10), pl.7(5,7).
15	Carnarvon Basin	(Balme'67).
16	Canning Basin	(Balme'73, pl.7(13), pl.8(5,8); (Balme'68).
17	S.Australia	(Balme'57; Har. & Lud.'66; Har. & McG.'68,'71).
18	Queensland	(Evans'64a,c,'66a,b,c,'67a; Burg.'70; Norv.'71; Rig.'73).
19	Sydney Basin	Helby'70, pl.1(11); (Balme & Henn.'56b; Evans'67b).
20	Tasmania	(Banks'62; Banks & Naqvi'67).





Paucipunctatosporites karrooensis gen. et. sp. nov.

REFERENCE POPULATION .	This paper, pl.67(1-11), 11 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1130' to 1133', L.Ecca equivalent.
HOLOTYPE	This paper, pl.67(1).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION . . .	After the Karroo Basin, S.Africa.
DESCRIPTION (ref. pop.) . .	as for genus.

CLOSELY RELATED SPECIES

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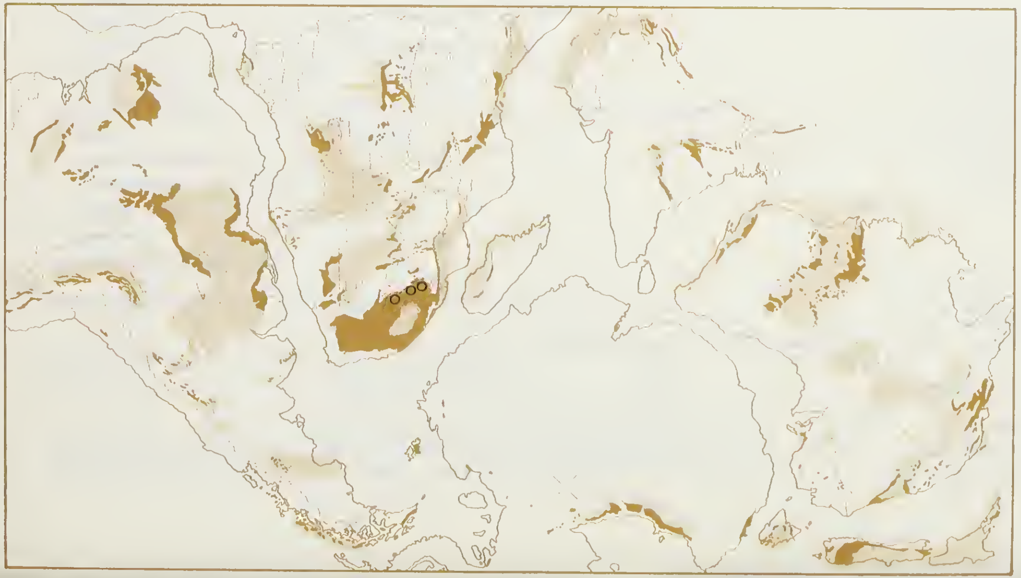
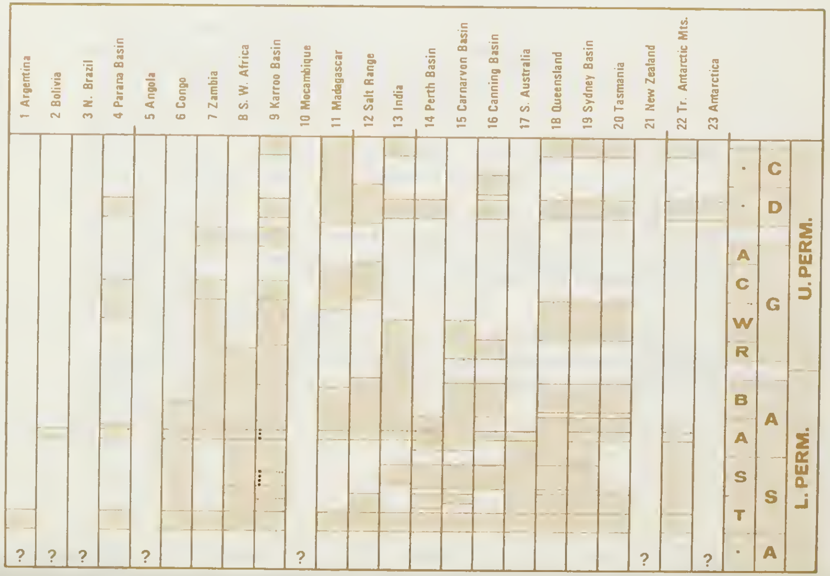
LITERATURE

9	Karroo Basin .	This paper, pl.67(1-11).



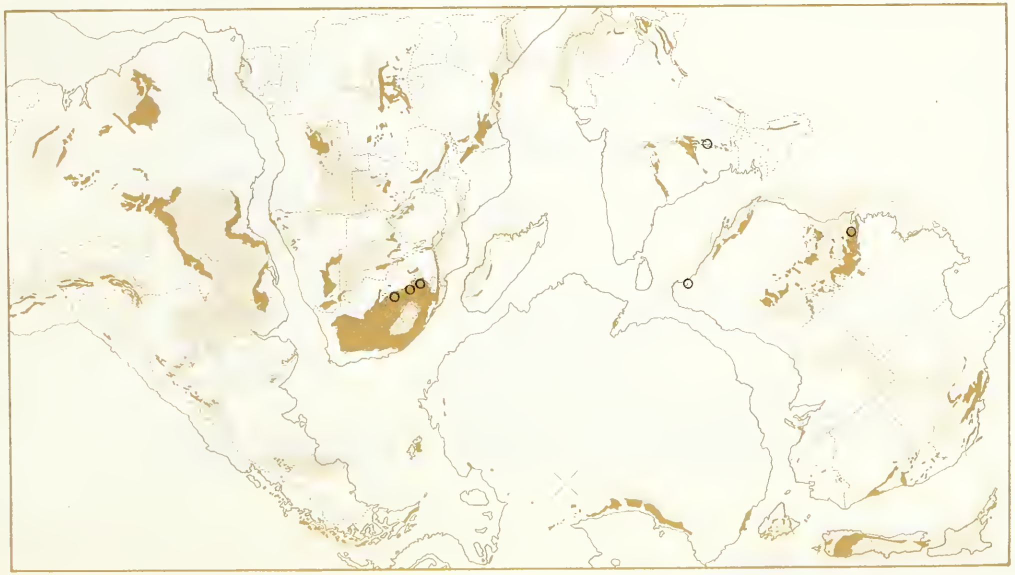


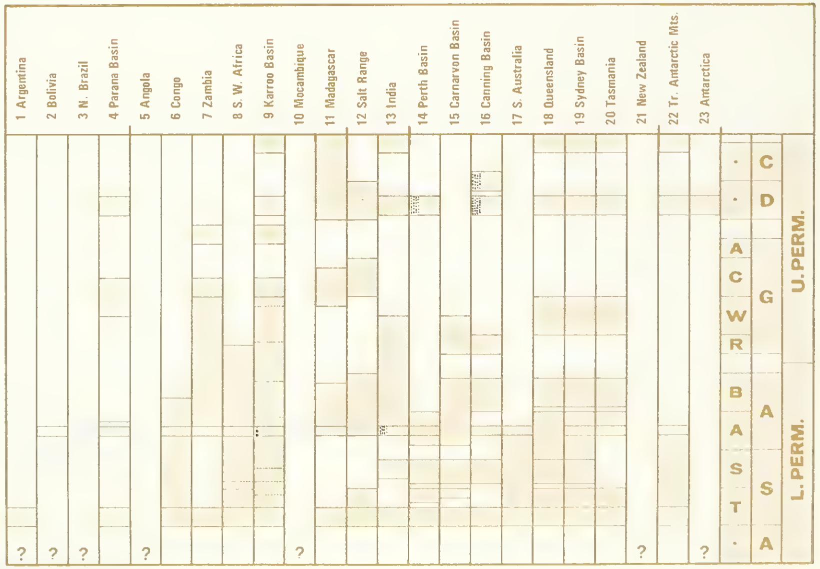
Altitriletes densus Venk. & Kar '68

REFERENCE POPULATION .	This paper, pl.68(1-15), 15 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Greylingstad/Bethal/Hendrina area. Borehole, WV3, 133,50m., M.Ecca.
HOLOTYPE	Original designation, Venk. & Kar '68a, pl.2(38,39), p.65.
TYPE LOCALITY	India, Bihar, N.Karanpura Basin. Surface locality, Badam village.
NAME DERIVATION . . .	L. densus = dense; (general appearance).
DESCRIPTION (ref. pop.) . .	as for genus.
CLOSELY RELATED SPECIES	—

LITERATURE

9	Karroo Basin .	This paper, pl.68,69 in full.
13	India	Venk. & Kar '68a, pl.2(38-42).
14	Perth Basin .	Glick.'72, pl.7(1-4).
16	Canning Basin .	Balme'73, pl.2(14).





Cyclogranisporites intrareticulatus sp. nov.

REFERENCE POPULATION .	This paper, pl.70(1-12), 12 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1000' to 1017', M.Ecca equivalent.
HOLOTYPE	This paper, pl.70(5).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION . . .	L. intra = inside; L. reticulatus = net like; (ornamentation).

DESCRIPTION (ref. pop.)

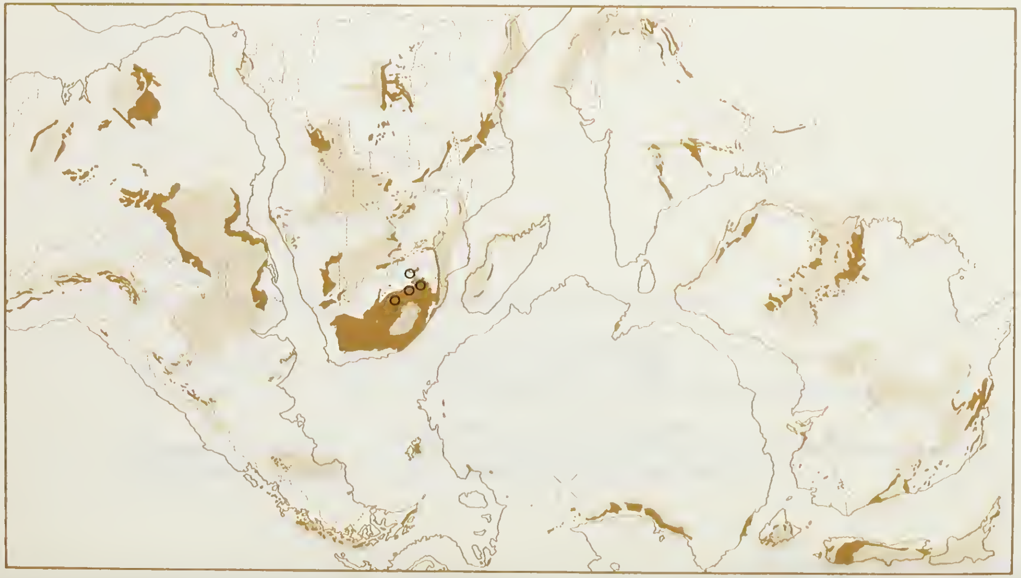
Shape	as for genus.
Contact faces	as for genus.
Trilete mark	as for genus.
Ornament. Arrangement .	as for genus.
Description .	Coarsely intrareticulate.
Size	44(55)66.

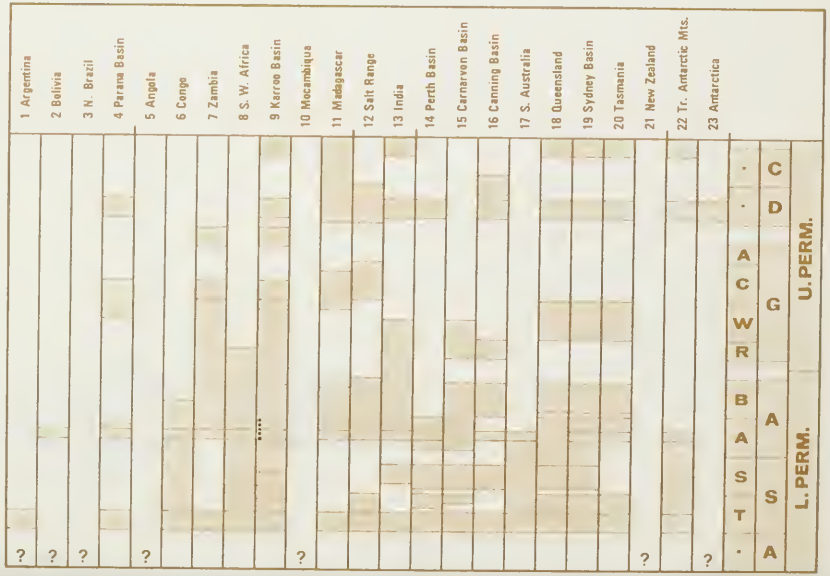
CLOSELY RELATED SPECIES

P.verrucosus	OO; pl.70(18) - pl.72(47).

LITERATURE

9	Karroo Basin .	This paper, pl.70(1-26).





Cyclogranisporites verrucosus sp. nov.

REFERENCE POPULATION .	This paper, pl.72(10-56), 53 specimens.
REFERENCE LOCALITY .	S.Africa, central Transvaal, Springbok Flats. Surface locality, HKr., M.Ecca.
HOLOTYPE	This paper, pl.72(47).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION . . .	L. verrucosus = warty; (ornamentation).

DESCRIPTION (ref. pop.)

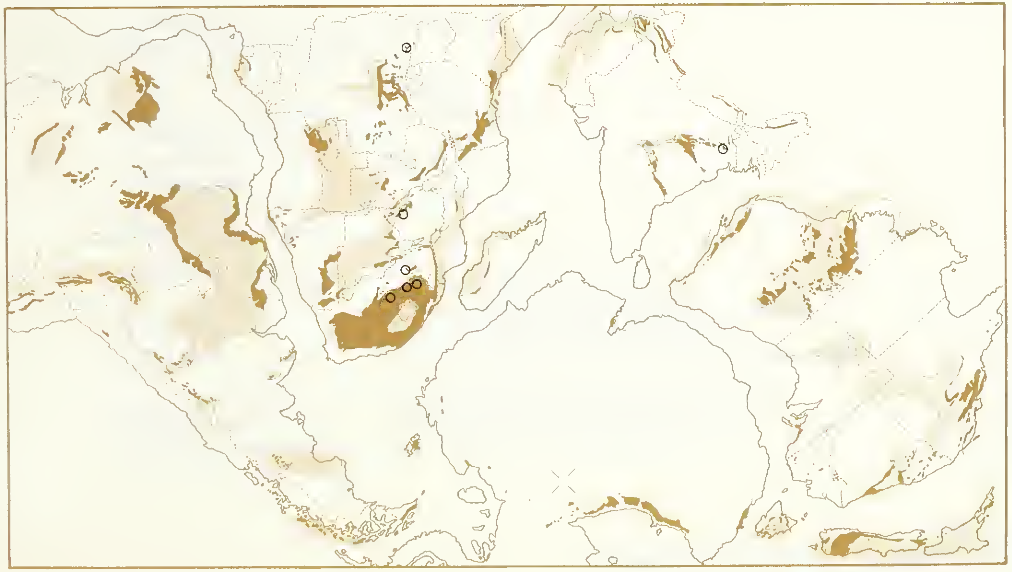
Shape		as for genus.
Contact faces		as for genus.
Trilete mark		as for genus.
Ornament.	Arrangement .	as for genus.
	Description .	Finely granulate to verrucose.
Size		36(47)58.

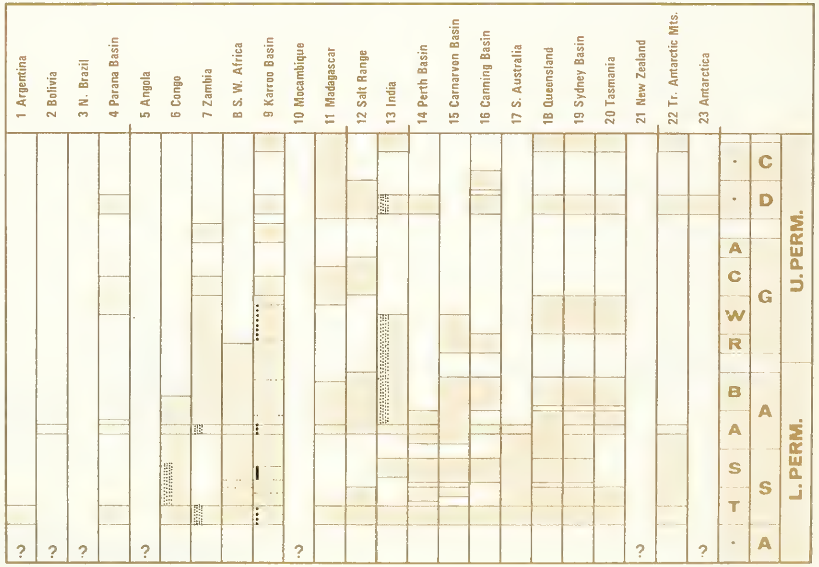
CLOSELY RELATED SPECIES

C.intrareticulatus	OO; pl.72(47) - pl.70(18).
C.parvus	O ; pl.72(10-56) - pl.72(1-9).
C.bhardwaji	OO ; pl.72(43) - pl.73(20).
P.verrucosus	OO; pl.72(47) - pl.76(38).

LITERATURE

6	Congo	Bose & Kar '66, pl.18(11).
7	Zambia	Falc.'72, pl.2(28-32).
9	Karroo Basin .	This paper, pl.71(1-28), pl.72(10-56).
13	India	Sriv.'55, pl.1(7); Bharad. & Sal.'64, pl.1(23,24); Sal.'65, pl.1(7); Kar'68a, pl.1(21).





Cyclogranisporties parvus (Lak., Sah, & Dube '60) comb. nov.

Planisporites parvus Lak., Sah, & Dube '60

REFERENCE POPULATION	This paper, pl.72(1-9), 10 specimens.
REFERENCE LOCALITY	S.Africa, central Transvaal, Springbok Flats. Surface locality, HKr., M.Ecca.
HOLOTYPE	Original designation, Lak., Sah & Dube '60, pl.1(2), pl.112.
TYPE LOCALITY	India, Uttar Pradesh, Himalayan region. Surface locality, Brewery near Naini Tal, Krol series.
NAME DERIVATION	L. parvus = small; (general size).

DESCRIPTION (ref. pop.)

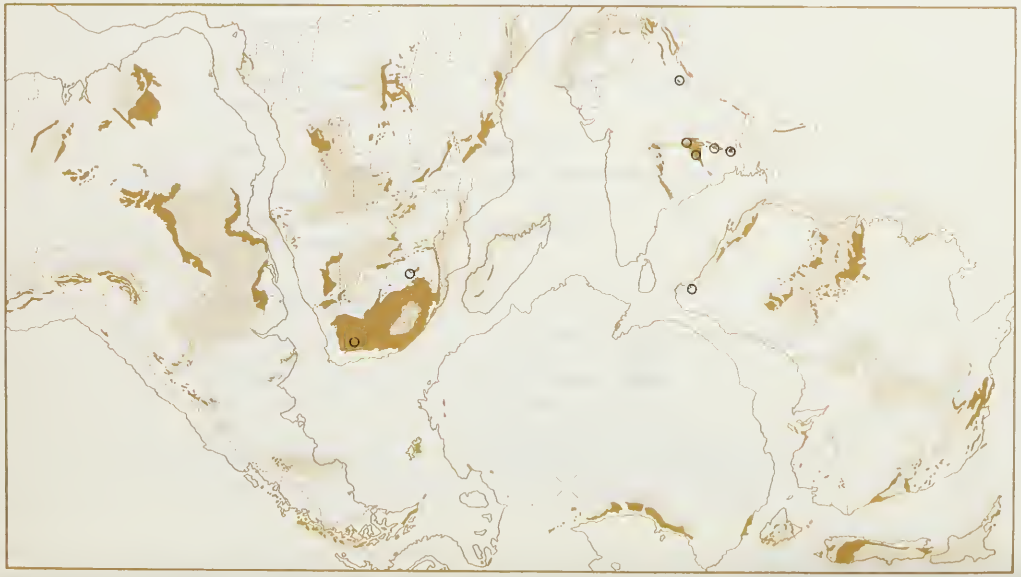
Shape		as for genus.
Contact faces		as for genus.
Trilete mark		as for genus.
Ornament.	Arrangement	as for genus.
	Description	Finely granulate.
Size		30(32)34.

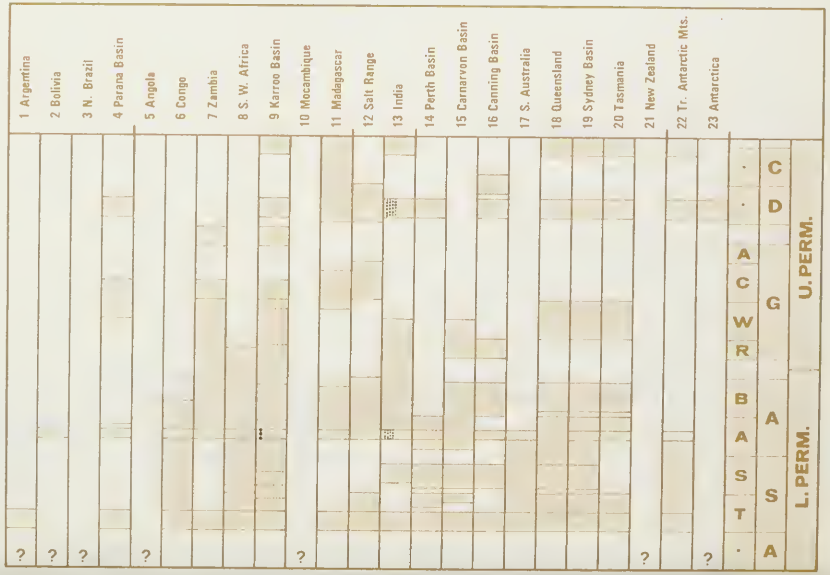
CLOSELY RELATED SPECIES

C.verrucosus . . . . ①; pl.72(1-9) - pl.72(10-56).

LITERATURE

9	Karroo Basin	This paper, pl.72(1-9).
12	Salt Range	Lak. et. al.'60, pl.1(2,3).
13	India	Bharad.'62, pl.1(11-14); Bharad. & Sal.'64, pl.1(19-22); Tiw.'65, pl.1(8,9); Sinha'72, pl.1(4).
14	Perth	Glick.'72, pl.8(4).





Cyclogranisporites bhardwaji (Hart '63) comb. nov.

Baculatisporites bhardwaji Hart '63

REFERENCE POPULATION .	This paper, pl.73(1-44), 44 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, OW, 94', Tapinocephalus Zone equivalent.
HOLOTYPE	Original designation, Hart '63, pl.1(5), p.11.
TYPE LOCALITY	Tanzania, Ruhuhu Valley. Surface locality, Ketewaka-Mchuchuma Coalfield, K2 Coal Measures.
NAME DERIVATION . . .	After Dr. Bharadwaj, palynologist.

DESCRIPTION (ref. pop.)

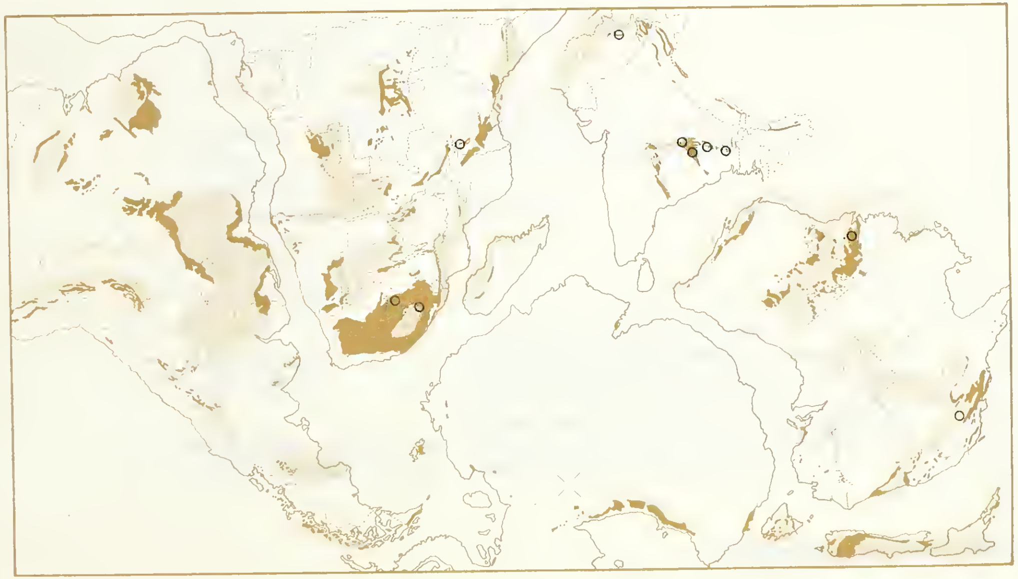
Shape		as for genus.
Contact faces		as for genus.
Trilete mark		as for genus.
Ornament.	Arrangement	as for genus.
	Description .	Granulate, conate, spinate, baculate, pilate (randomly intermixed on a single specimen).
Size		36(45)54.

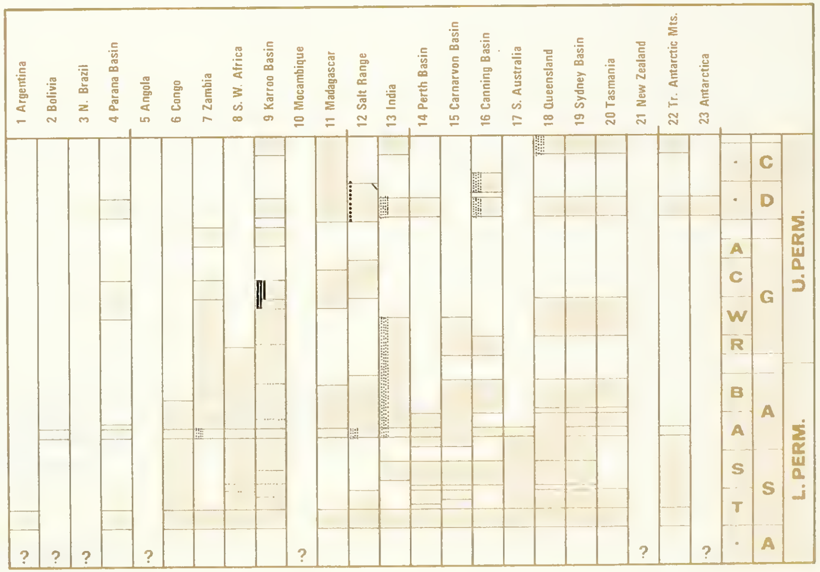
CLOSELY RELATED SPECIES

C.verrucosus	OD ; pl.73(20) - pl.72(43).
P.verrucosus	OO; pl.73(20) - pl.76(38).

LITERATURE

7	Zambia . . .	Hart '63b, pl.1(5,6).
9	Karroo Basin .	This paper, pl.73(1-53).
12	Salt Range . .	Venk. & Kar '68b, pl.1(6-8); Balme '70, pl.2(7,8).
13	India	Bharad. & Sal.'64, pl.2(47-49). Bharad. & Sal.'65a, pl.1(8,21,22); Tiw.'65, pl.2(38,39); Sal.'65, pl.1(15-18); Mahesh.'67, pl.1(5,6); Kar '68a, pl.1(10); Sinha '72, pl.1(13).
16	Canning Basin .	Balme '73, pl.2(17);
18	Queensland . .	deJers.'70, pl.1(11).





Calamospora aplata Bharad. & Sal.'64

REFERENCE POPULATION . This paper, pl.74(1-19), 19 specimens.
REFERENCE LOCALITY . S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, OW, 94', Tapinocephalus Zone equivalent.

HOLOTYPE . . . . Original designation, Bharad. & Sal.'64, pl.1(13), p.191.
TYPE LOCALITY . . . . India, Bihar, E. Raniganj Coalfield. ? Colliery, seam VIII, Raniganj Stage.

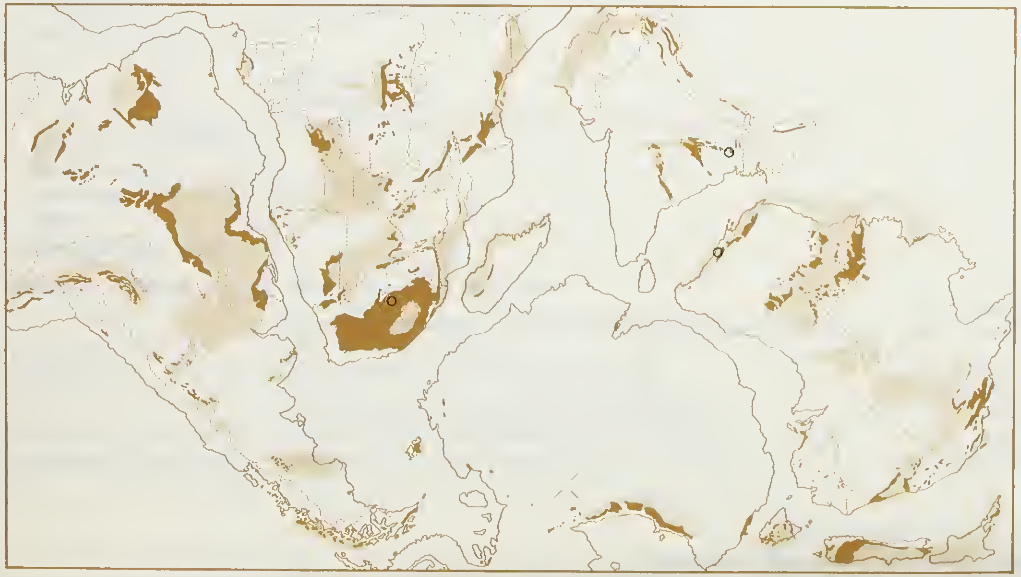
NAME DERIVATION . . . ?

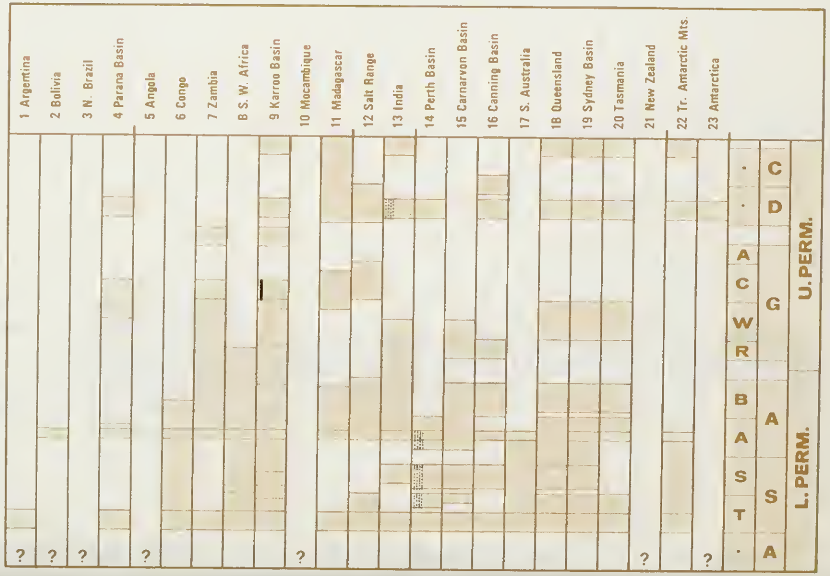
DESCRIPTION (ref. pop.)
- **Shape** . . . . } as for genus.
- **Contact faces** . . . . } as for genus.
- **Trilete mark** . . . . . } as for genus.
- **Torus** . . . . Weakly developed plane field-tori.
- **Ornament.** Arrangement Unordered but evenly distributed throughout.
- Description . Very faintly granulate.
- **Size** . . . . 34(46)58.

CLOSELY RELATED SPECIES
C.sinesignis . . . . . . OO; pl.74(9) - pl.74(32).

LITERATURE

9	Karroo Basin	.	This paper, pl.74(1-28).
13	India . . .	.	Bharad. & Sal.'64, pl.1(13-15).
14	Perth Basin	.	Segr.'70, pl.1(F).





Calamospora sinesignis sp. nov.

REFERENCE POPULATION . This paper, pl.74(29-40), 12 specimens.
REFERENCE LOCALITY . S.Africa, northern Karroo Basin, Oliviershoek Pass area. Surface locality, Kb, L.Beaufort (Daptocephalus Zone).

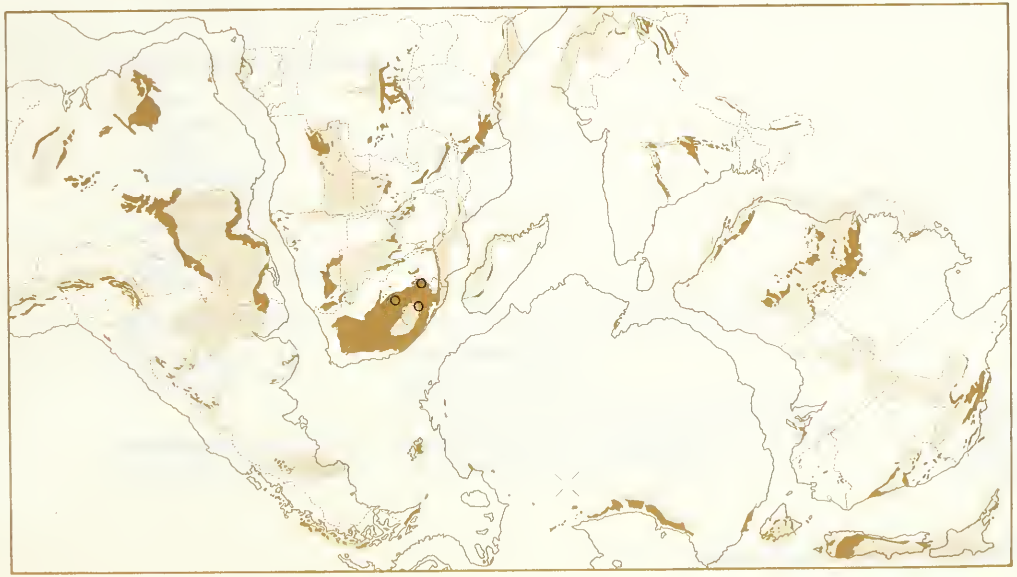
HOLOTYPE . . . . . . This paper, pl.74(31).
TYPE LOCALITY . . . . As for reference locality.

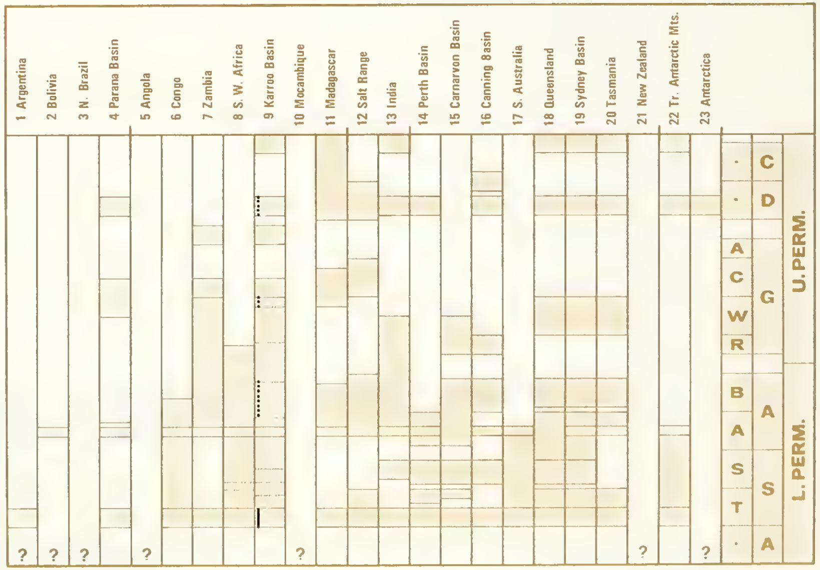
NAME DERIVATION . . . L. sine = without; L. signum = the sign, mark; (lacking tori).

DESCRIPTION (ref. pop.)
Shape . . . . } as for genus.
Contact faces . . . . } as for genus.
Trilete mark . . . . . } as for genus.
Torus . . . . —
Ornament. Arrangement —
Description . Levigate.
Size . . . . 40(47)54.

CLOSELY RELATED SPECIES
C.aplata . . . . . . ꝏ; pl.74(32) - pl.74(9).

LITERATURE
9 Karroo Basin . This paper, pl.74(29-40).





Inaperturosporites inapertus gen. et. sp. nov.

REFERENCE POPULATION .	This paper, pl.75(1-19), 19 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, OW, 94', Tapinocephalus Zone equivalent.
HOLOTYPE	This paper, pl.75(5).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION . . .	L. in = no; L. apertus = aperture; (alete nature).

DESCRIPTION (ref. pop.)

Shape	as for genus.
Contact faces	as for genus.
Trilete mark	as for genus.
Ornamentation	as for genus.
Exine	See notes for genus.
? Perine	—
Size	46(54)62.

CLOSELY RELATED SPECIES

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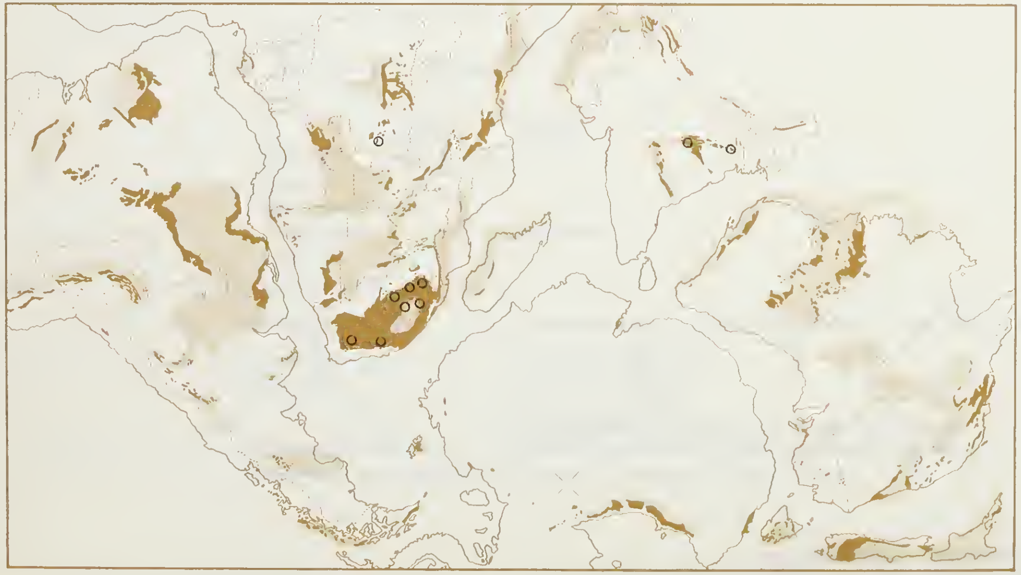
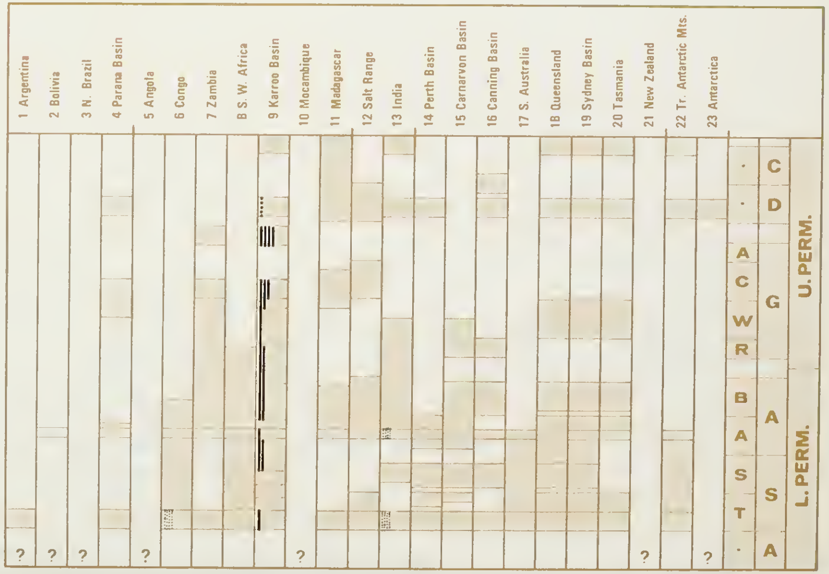
LITERATURE

6	Congo . . .	Mahesh.'69, pl.1(4,6).
9	Karroo Basin .	This paper, pl.75(1-19).
13	India	Sinha'69, pl.1(16,17); Lele & Karim'71, pl.3(37,38).





Inaperturosporites vesiculatus sp. nov.

REFERENCE POPULATION . This paper, pl.75(20-27), 8 specimens.
REFERENCE LOCALITY . S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, OW, 94', Tapinocephalus Zone equivalent.

HOLOTYPE . . . . This paper, pl.75(21).
TYPE LOCALITY . . . . As for reference locality.

NAME DERIVATION . . . L. vesiculatus = vesicular; (Membranous exoexine).

DESCRIPTION (ref. pop.)

- **Shape** . . . . as for genus.
- **Contact faces** . . . . as for genus.
- **Trilete mark** . . . . . as for genus.
- **Ornamentation** . . . . as for genus.
- **Exine** . . . . See notes for genus.
- **? Perine** . . . . A very thin well separated perine occurs.
- **Size** . . . . 54 (64) 74.

CLOSELY RELATED SPECIES

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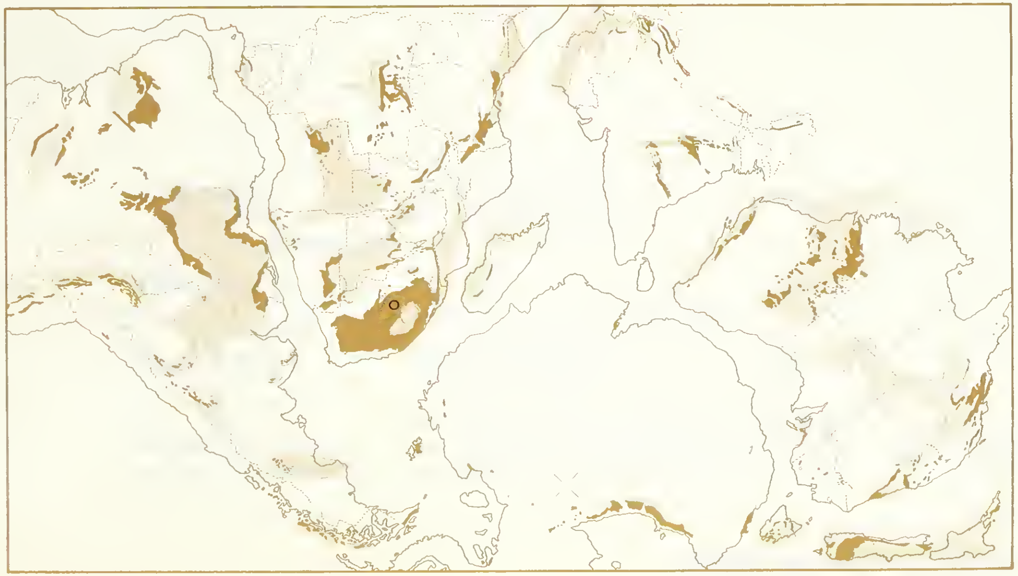
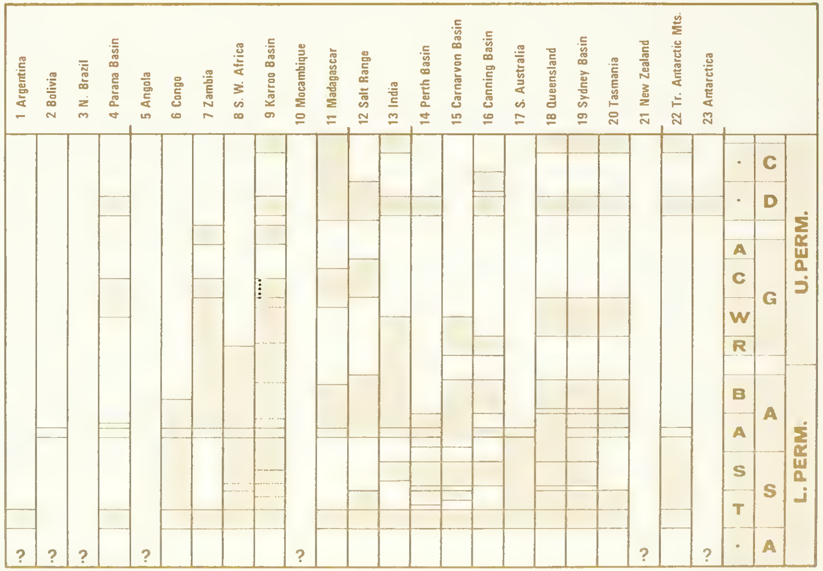
LITERATURE

9	Karroo Basin	This paper, pl.75(20-27).



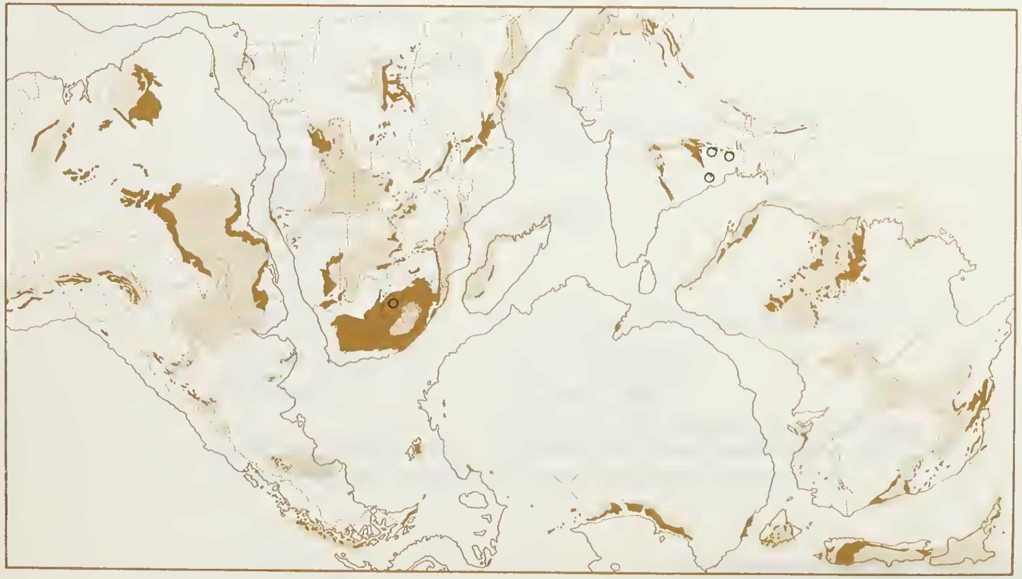


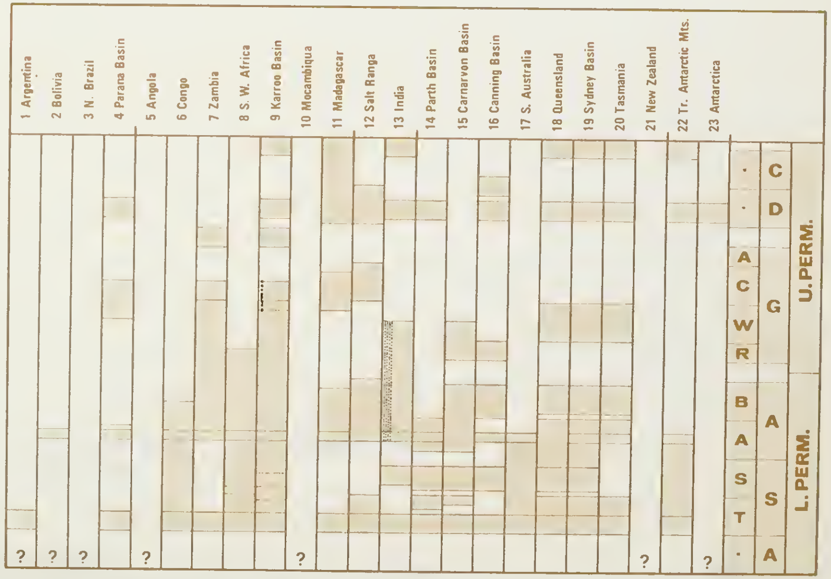
Partimtactosporites verrucosus gen. et. sp. nov.

REFERENCE POPULATION .	This paper, pl.76(1-38), 38 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, OW, 94', Tapinocephalus Zone equivalent.
HOLOTYPE	This paper, pl.76(28).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION . . .	L. verrucosus = warty; (ornamentation).
DESCRIPTION (ref. pop.) . .	as for genus.
CLOSELY RELATED SPECIES	
C.verrucosus	OO; pl.76(38) - pl.72(47).
C.bhardwaji	OO; pl.76(38) - pl.73(20).

LITERATURE

9	Karroo Basin .	This paper, pl.76(1-38).
13	India	Venk. & Kar'68a, pl.1(11,12); Kar 68a, pl.1(7-9,19,20); Sriv.'70, pl.1(2-4).





Apiculatisporis diversiformis (Balme & Henn.'56) comb. nov.

Calamospora diversiformis Balme & Henn.'56

REFERENCE POPULATION .	This paper, pl.77(1-10), 10 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1133', L.Ecca equivalent.
HOLOTYPE	Not designated to date.
TYPE LOCALITY	N.S.W. Sydney Basin. Cessnock No.1 Colliery, Main Greta seam, Greta Coal Measures.
NAME DERIVATION . . .	L. diversus = diverse; L. formis = form, shape; (range of variation).

DESCRIPTION (ref. pop.)

Shape		as for genus.
Contact faces		as for genus.
Trilete mark	Rays .	as for genus.
	Labra	No labra.
	Tori . .	Narrow convex band tori.
Ornament.	Arrangement	as for genus.
	Description .	Levigate.
Size		26(30)34.

CLOSELY RELATED SPECIES

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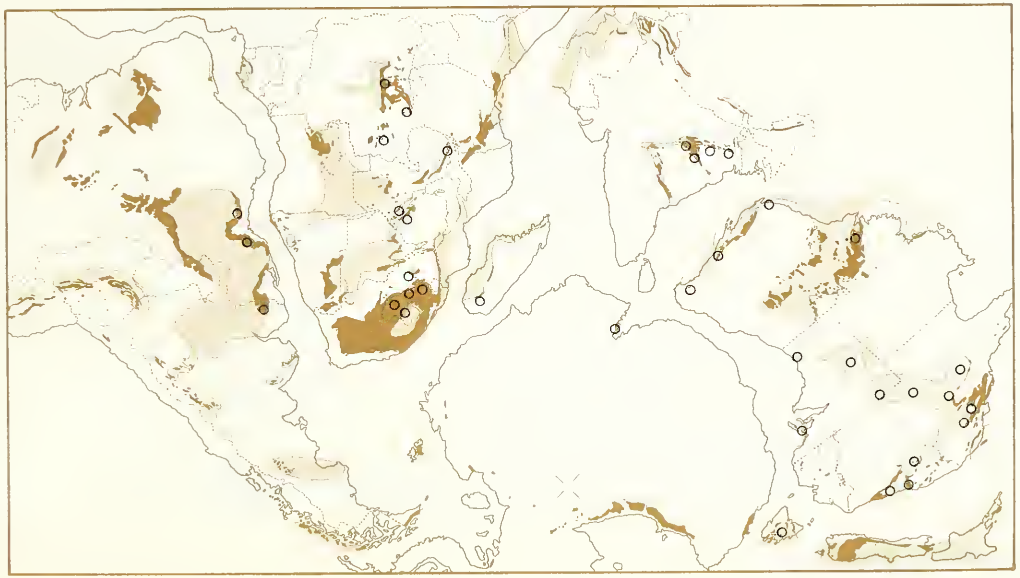
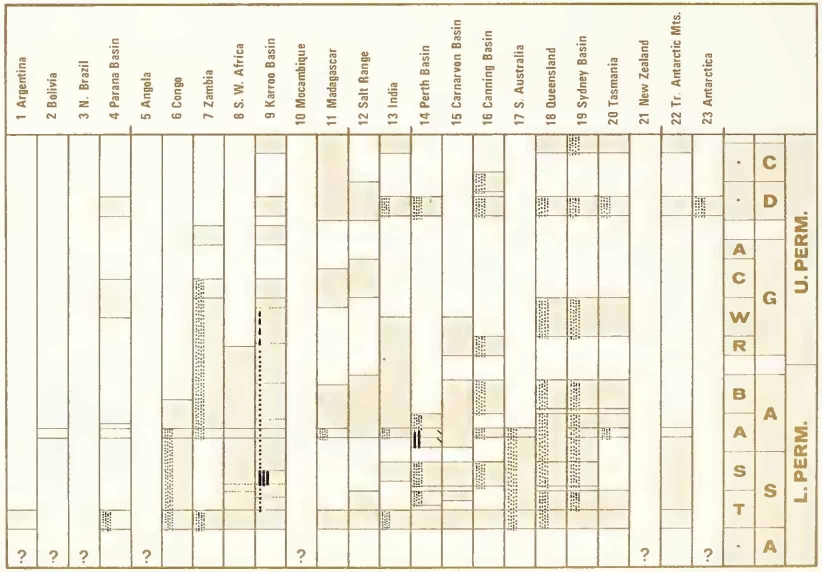
LITERATURE

4	Parana Basin . .	Bharad.'69, pl.1(4,9); Kemp (in press), pl.1(9).
6	Congo . . .	Pier.'59, pl.7(4); Bose & Kar'66, pl.1(2), pl.30(10); Kar & Bose'67, pl.1(7,17). Bose & Mahesh.'68, pl.4(5); Mahesh.& Bose'69, pl.2(6).
7	Zambia . . .	Falc.'72, pl.1(7-9); (Utt.'70).
9	Karroo Basin .	This paper, pl.77(1-18).
11	Madagascar . .	Rakoto.'70, pl.3(1-4,12).
13	India	Pot & Lele'61, pl.1(10); Bharad.'62, pl.1(9,10); Bharad. & Sal.'64, pl.1(18). Bharad. & Tiw.'64b, pl.1(6); Tiw.'65, pl.1(6,7); Sal.'65, pl.1(1-3); Bharad.'66, pl.3(30,31); Nav. & Tiw.'67, pl.1(8); Venk. & Kar'68a, pl.1(3,4).
	Australia . . .	Balme & Henn.'56, pl.3(14-18); Balme'64, pl.3(2).
14	Perth Basin . .	Balme'52, pl.1(-); Segr.'70, pl.2(A); Segr.'72, pl.4(3); Glick.'72, pl.8(6-9).
15	Carnarvon Basin .	(Balme & Henn.'56b).
16	Canning Basin .	Balme'73, pl.2(9), pl.4(3), pl.5(1), pl.7(4); (Balme & Henn.'56b).
17	S.Australia . .	(Har. & Lud.'66; Har. & McG.'68,'71).
18	Queensland . .	(Balme & Henn.'56b; Evans'64a,c,'66a,b,c,'67a; Burg.'70; deJers.'70; Norv.'71; Rig.'73).
19	Sydney Basin .	Helby'70, pl.1(12,15-17); (Balme & Henn.'56b; Evans'67b).
20	Tasmania . . .	(Balme & Henn.'56b; Banks & Naqvi'67).
23	Antarctica . .	Balme & Playf.'67, pl.1(3).





Apiculatisporis minor sp. nov.

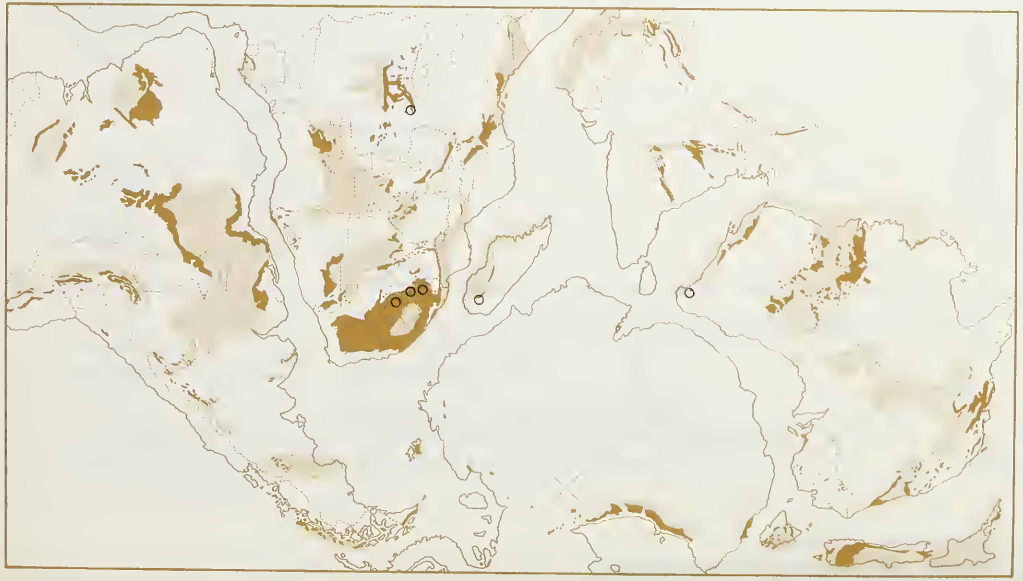
REFERENCE POPULATION		This paper, pl.77(19-28), 10 specimens.
REFERENCE LOCALITY		S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1133', L.Ecca equivalent.
HOLOTYPE		This paper, pl.77(25).
TYPE LOCALITY		As for reference locality.
NAME DERIVATION		L. minor = smaller; (relative overall size).
DESCRIPTION (ref. pop.)		
Shape		as for genus.
Contact faces		as for genus.
Trilete mark	Rays	as for genus.
	Labra	Parallel sided labra stretch full length of rays.
	Tori	Tori apparently absent.
Ornament.	Arrangement	as for genus.
	Description	Bulbous granulae baring single setula.
Size		24(26)28.

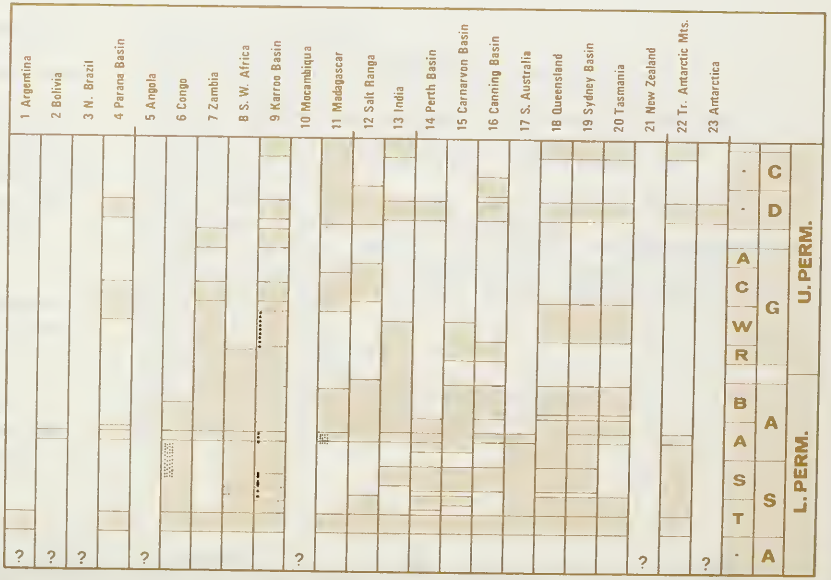
CLOSELY RELATED SPECIES

A.major	O͟O; pl.77(28) - pl.77(29).
A.levis	O͟O; pl.77(28) - pl.77(36).
A.bulliensis	O͟O; pl.77(28) - pl.78(15).

LITERATURE

6	Congo	Kar & Bose'67, pl.1(11,15).
9	Karroo Basin	This paper, pl.77(19-28).
11	Madagascar	Rakoto.'70, pl.1(8,13).
14	Perth	Glick.'72, pl.8(2).





Apiculatisporis major sp. nov.

REFERENCE POPULATION .	This paper, pl.77(29-35), 6 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1133', L.Ecca equivalent.
HOLOTYPE	This paper, pl.77(33,34).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION . . .	L. major = greater; (relative overall size).

DESCRIPTION (ref. pop.)

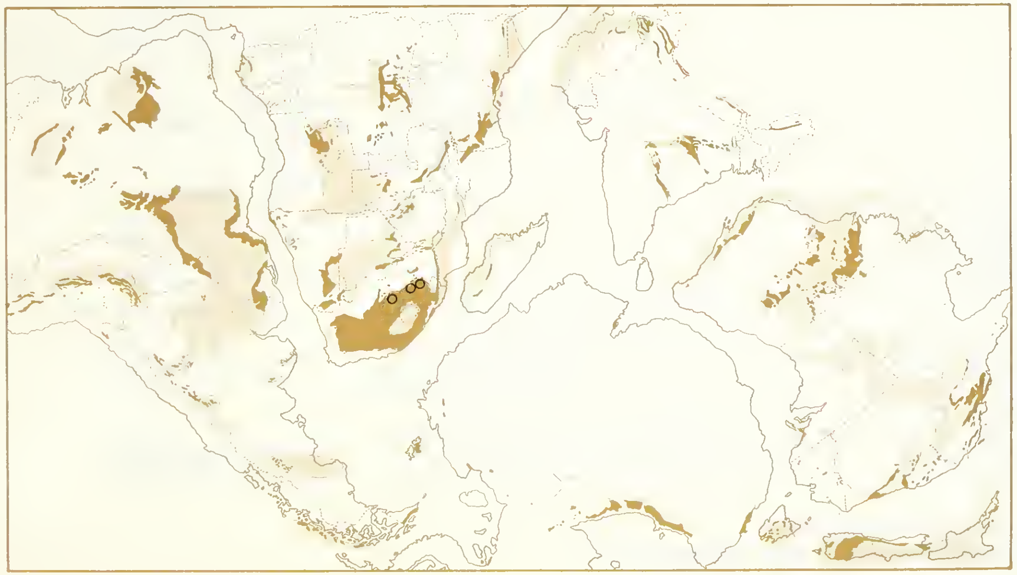
Shape		as for genus.
Contact faces		as for genus.
Trilete mark	Rays . .	as for genus.
	Labra . .	Tapering labra stretch full length of rays.
	Tori . .	Diffuse tori.
Ornament.	Arrangement	as for genus.
	Description .	Bulbous granulae baring single setula.
Size		30(32) 34.

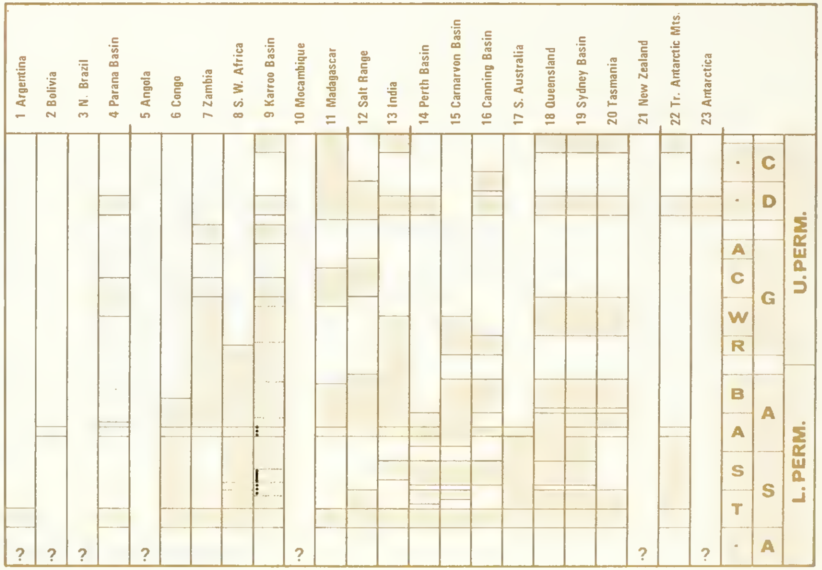
CLOSELY RELATED SPECIES

A.minor	OO; pl.77(29) - pl.77(28).
A.levis	OO; pl.77(29) - pl.77(36).
A.cornutus	OO; pl.77(35) - pl.78(25).

LITERATURE

9	Karroo Basin .	This paper, pl.77(29-35).





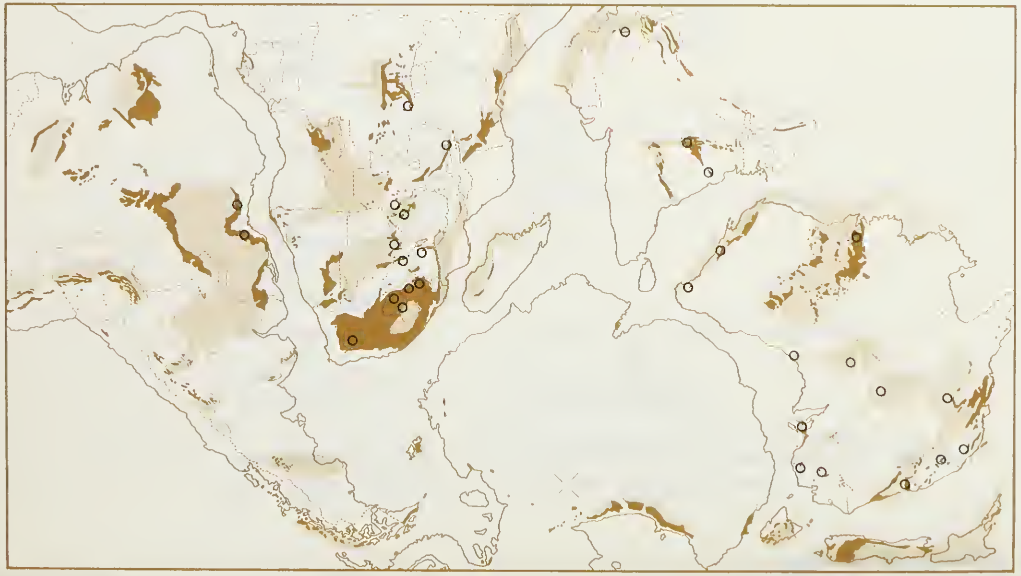
Apiculatisporis levis (Balme & Henn.'56) Bose & Mahesh.'68

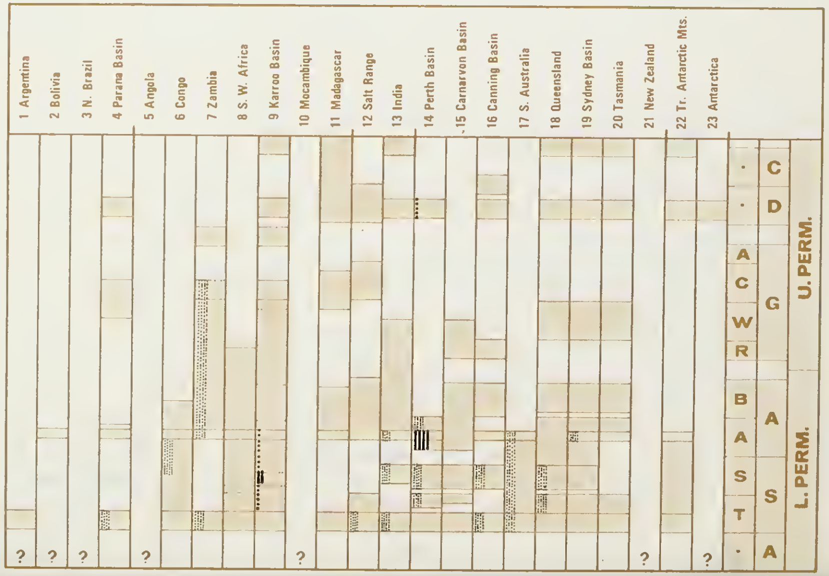
Apiculatisporites levis Balme & Henn.'56

REFERENCE POPULATION .	This paper, pl.77(36-44), 9 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1133', L.Ecca equivalent.
HOLOTYPE	Not designated to date.
TYPE LOCALITY	W.Australia, Collie Basin. Proprietary Colliery, Main seam, Collie Fm.
NAME DERIVATION . . .	L. levis = light (in weight); (general appearance).
DESCRIPTION (ref. pop.)	
Shape	as for genus.
Contact faces	as for genus.
Trilete mark Rays . .	as for genus.
Labra . .	No labra.
Tori . .	Diffuse tori.
Ornament. Arrangement	as for genus.
Description .	Bulbous granulae baring single setula.
Size	30(35)40.
CLOSELY RELATED SPECIES	
A.minor	OO; pl.77(36) - pl.77(28).
A.major	OO; pl.77(36) - pl.77(29).
A.cornutus	ꝏ ; pl.77(37) - pl.78(35).

LITERATURE

4	Parana Basin . .	Kemp (in press), pl.1(1).
6	Congo . . .	Kar & Bose'67, pl.1(12).
7	Zambia . .	Falc.'72, pl.2(1,2); (Utt.'70).
9	Karroo Basin .	This paper, pl.77(36-44); (Hart'66b).
12	Salt Range . .	Kemp (in press), pl.2(1).
13	India	Pot. & Lele'61, pl.1(13,15,17); Nav.'66, pl.2(16); Tiw. & Moiz'71, pl.1(1-8); Sinha'72, pl.1(14-16).
	Australia . .	Balme & Henn.'56b, pl.2(19-21), pl.5(51,52).
14	Perth Basin . .	Segr.'70, pl.5(I); Segr.'72, pl.4(5); Glick.'72, pl.8(1,3).
16	Canning Basin .	Balme"73, pl.7(1), pl.8(3).
17	S.Australia . .	(Har. & Lud.'66; Doug.'69; Har. & McG.'68,'71).
18	Queensland . .	(Pat.'69; deJers.'73; Rig.'73).
19	Sydney Basin .	(McK. & Gut.'69).





Apiculatisporis bulliensis (Henn.'58) comb. nov.

Apiculatisporites bulliensis Henn.'58

REFERENCE POPULATION .	This paper, pl.78(1-12), 12 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Oliviershoek Pass area. Surface locality, Kb, L. Beaufort (Daptocephalus Zone).
HOLOTYPE	Not designated to date.
TYPE LOCALITY	N.S.W., Sydney Basin. Borehole, Appin No.4, 1696'10"-1697'5", lowermost Narrabeen Grp.
NAME DERIVATION . . .	After Bulli seam, Sydney Basin, N.S.W.

DESCRIPTION (ref. pop.)

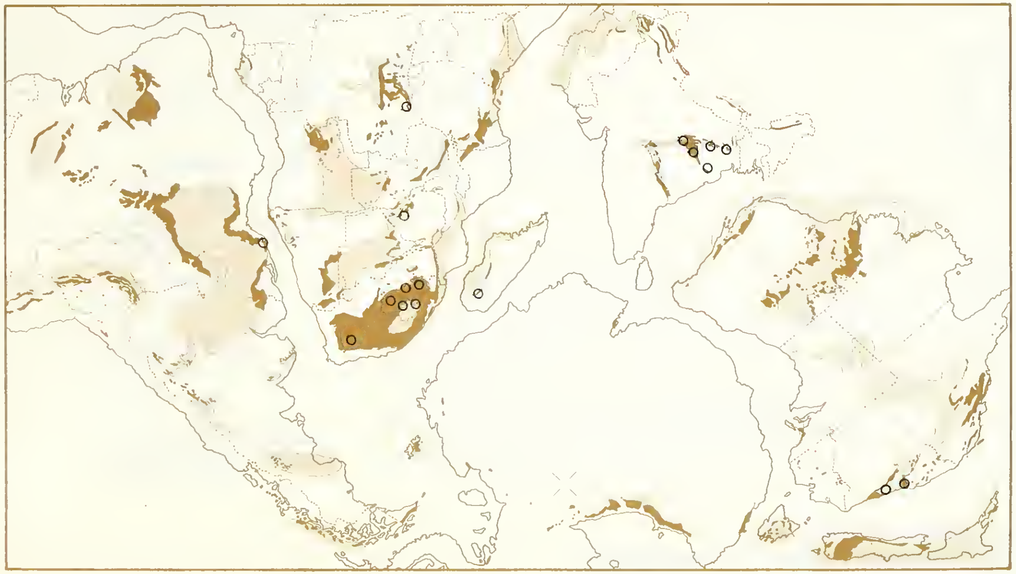
Shape		as for genus.
Contact faces		as for genus.
Trilete mark	Rays . .	as for genus.
	Labra . .	Parallel sided labra stretch full length of rays.
	Tori . .	No tori.
Ornament.	Arrangement	as for genus.
	Description .	Coarsely conate.
Size		22 (25) 28.

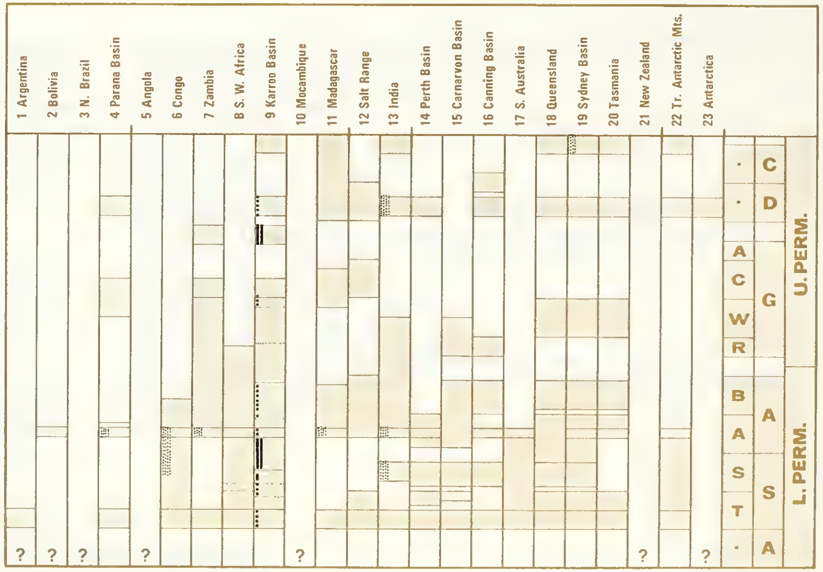
CLOSELY RELATED SPECIES

A.minor	OO; pl.78(15) - pl.77(28).
A.cornutus	⦶ ; pl.78(18-21) - pl.78(22-28).

LITERATURE

4	Parana Basin . .	Tiw. & Nav.'67, pl.1(11).
6	Congo . . .	Bose & Mahesh.'68, pl.4(7-9).
7	Zambia . . .	Falc.'72, pl.2(4,5).
9	Karroo Basin .	This paper, pl.78(1-21).
11	Madagascar . .	Rakoto.'70, pl.5(12-18).
13	India	Bharad. & Sal.'64, pl.2(41.42); Bharad. & Tiw.'64b, pl.1(13); Bharad. & Sal.'65a,pl.1(16); Sal.'65, pl.1(9-12); Tiw.'65, pl.1(17,18); Bharad. & Tiw.'66, pl.1(2,3); Nav. & Tiw.'66, pl.1(2); Nav. & Tiw.'68, pl.1(2,3); Tiw.'68, pl.1(12-16); Bharad. & Sriv.'69d, pl.1(17-20); Sinha'72, pl.1(19,20).
19	Sydney Basin .	Henn.'58, pl.5(3-5); Helby'70, pl.2(1,2,6-8); (Evans'67b).





Apiculatisporis cornutus (Balme & Henn.'56) Hoeg & Bose '60

Apiculatisporites cornutus Balme & Henn.'56

REFERENCE POPULATION . This paper, pl.78(22-28), 7 specimens.

REFERENCE LOCALITY . S.Africa, northern Karroo Basin, Welkom/Virginia area.
Borehole, SAP 6, 1130'-1133', L.Ecca equivalent.

HOLOTYPE . . . . Not designated to date.

TYPE LOCALITY . . . . N.S.W., Sydney Basin.
Cessnock No.1 Colliery, Main Greta seam, Greta Coal Measures.

NAME DERIVATION . . . L. cornutus = horned; (ornamentation).

DESCRIPTION (ref. pop.)

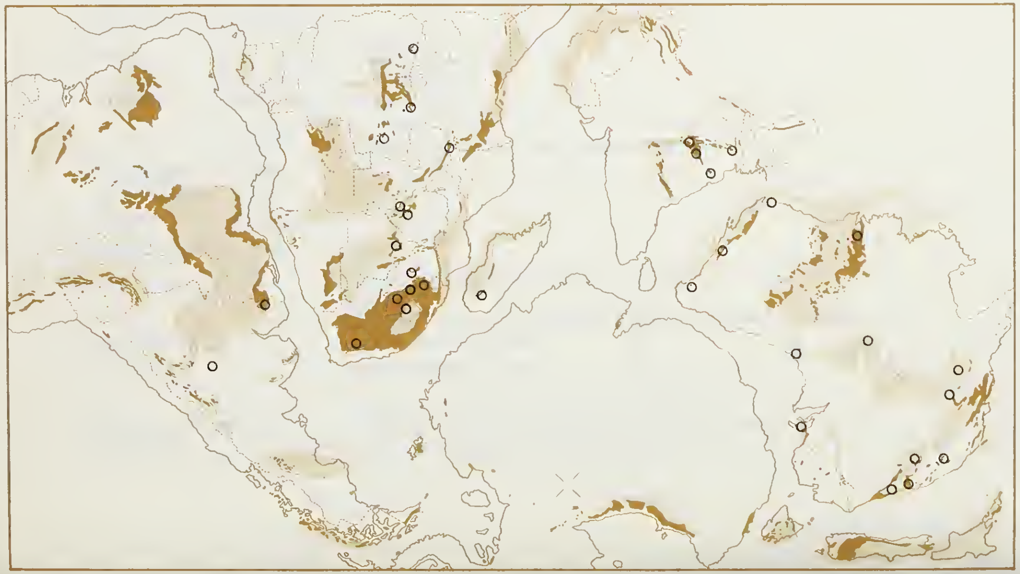
Shape		as for genus.
Contact faces		as for genus.
Trilete mark	Rays	as for genus.
	Labra	Parallel sided labra stretch full length of rays.
	Tori	No tori.
Ornament.	Arrangement	as for genus.
	Description	Coasely conate.
Size		32(36)40.

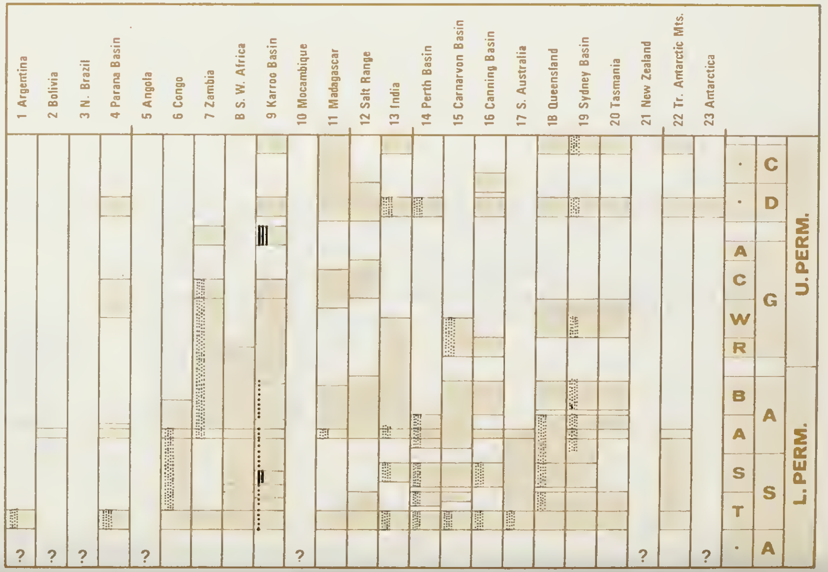
CLOSELY RELATED SPECIES

A.major	OO; pl.78(25) - pl.77(35).
A.levis	ↀ ; pl.78(35) - pl.77(37).
A.bulliensis	0 ; pl.78(22-28) - pl.78(18-21).

LITERATURE

1	Argentina	Menend.'69, pl.1(10).
4	Parana Basin	Bharad.'69, pl.1(18,19).
6	Congo	Pier.'59, pl.7(3); Hoeg & Bose'60, pl.31(4,5); Bose & Kar'66, pl.19(9,10); Kar & Bose'67, pl.2(2,4,5); Bose & Mahesh.'68, pl.4(10-12); Mahesh. & Bose'69, pl.2(9-12,15,16), pl.4(15).
7	Zambia	Falc.'72, pl.2(3,6); (Utt.'70).
9	Karroo Basin	This paper, pl.78(22-39); (Hart'66b).
11	Madagascar	Rakoto.'70, pl.5(7-11).
13	India	Pot. & Lele'61, pl.1(22-25); Bharad. & Sal.'64, pl.2(43); Tiw.'65, pl.1(19,20,28-30); Nav.'66, pl.2(14); Nav. & Tiw.'66, pl.1(1,4); Bharad.'66, pl.1(4), pl.2(15), pl.3(28); Nav. & Tiw.'67, pl.8(6); Tiw.'68, pl.1(10,11).
	Australia	Balme & Henn.'56b, pl.2(24-26).
14	Perth Basin	Segr.'70, pl.4(G-I); Segr.'72, pl.2(4); Glick.'72, pl.8(11,12).
15	Carnarvon Basin	(Balme'67).
16	Canning Basin	Balme'73, pl.7(5), pl.8(4).
17	S.Australia	(Evans'64b; Har. & Lud.'66; Har. & McG.'71).
18	Queensland	(Evans'64a,c,'66a,b,c,'67a; Burg.'70; Rig.'73).
19	Sydney Basin	Helby'70, pl.2(3-5); (Balme & Henn.'56b; Evans'67b; McK. & Gut.'69).





Polypodiisporites detritus (Leschik '59) comb. nov.

Verrucososporites detritus Leschik '59

REFERENCE POPULATION	This paper, pl.79(26-41), 16 specimens.
REFERENCE LOCALITY	S.Africa, central Transvaal, Springbok Flats. Surface locality, HKr., M.Ecca.
HOLOTYPE	Original designation, Lesch.'59, pl.1(8), p.58.
TYPE LOCALITY	S.W.Africa, Kalahari Basin. Surface locality, near Norranaub, coaly lense in Nossob Sdst.
NAME DERIVATION	L. detritus = detritus; (? ornamentation).

DESCRIPTION (ref. pop.)

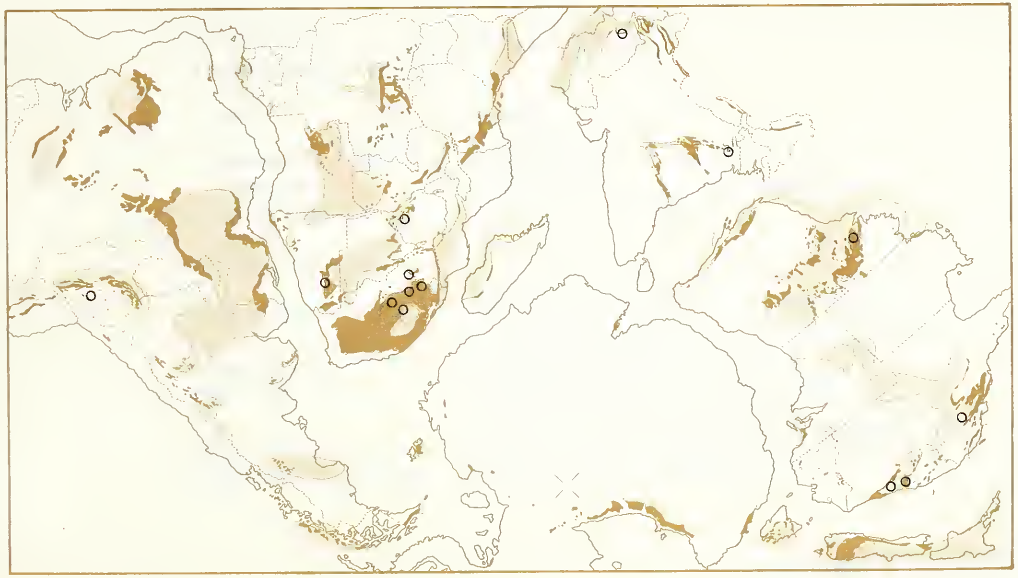
Shape		as for genus.
Contact faces		as for genus.
Trilete mark		Monolete mark.
Ornament.	Arrangement	as for genus.
	Description	Medium to coarsely obervermiculate.
Size		28 (35) 42.

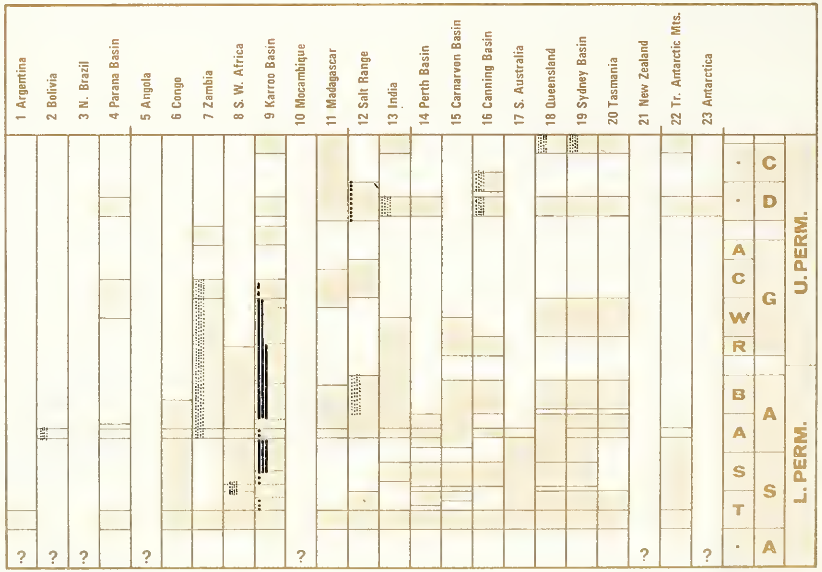
CLOSELY RELATED SPECIES

P.mutabilis	ꝎD; pl.79(4) - pl.79(42).

LITERATURE

2	Bolivia	Cousm.'65, pl.128(6-13,15,16).
7	Zambia	Falc.'72, pl.3(28-35).
8	S.W.Africa	Lesch.'59, pl.1(8-11,13).
9	Karroo Basin	This paper, pl.79(1-41).
12	Salt Range	Balme'70, pl.6(4-6).
13	India	Bharad.'62, pl.5(80,81); Bharad. & Sal.'64, pl.3(66,67).
16	Canning Basin	Balme'73, pl.2(11).
18	Queensland	deJers.'70, pl.4(14).
19	Sydney Basin	Helby '70, pl.25(6-9,11-20,24,25).





Polypodiisporites mutabilis Balme '70

REFERENCE POPULATION .	This paper, pl.79(42-49), 8 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, OW, 94', Tapinocephalus Zone equivalent.
HOLOTYPE	Original designation, Balme '70, pl.6(9), p.347.
TYPE LOCALITY	West Pakistan, Salt Range. Surface locality, Field no. K11-2D, Wargal, Chhidru Fm.
NAME DERIVATION . . .	L. mutabilis = changeable, mutable; (monolete mark).

DESCRIPTION (ref. pop.)

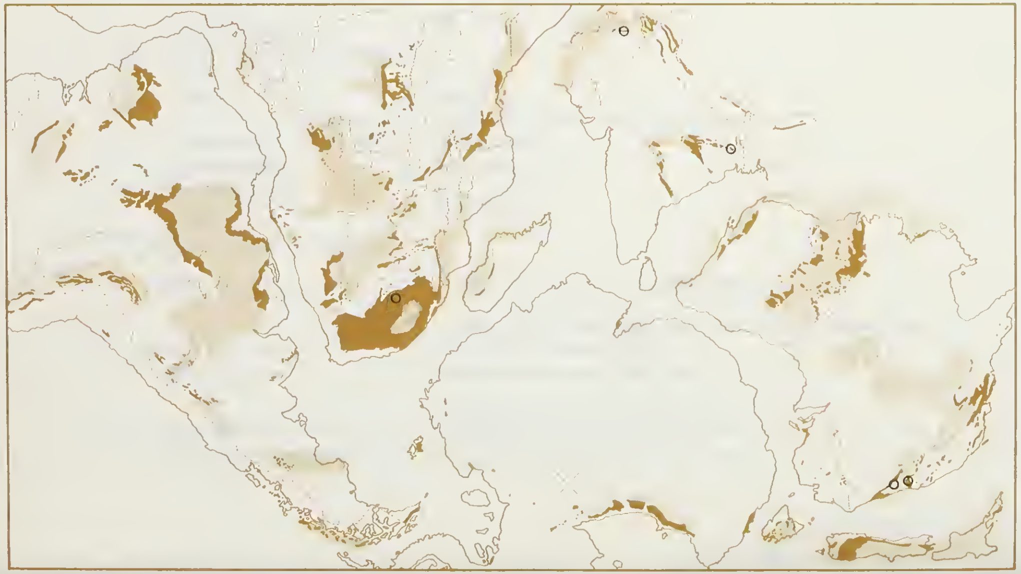
Shape		as for genus.
Contact faces		as for genus.
Trilete mark		Monolete mark (often tending to irregular trilete).
Ornament.	Arrangement	as for genus.
	Description .	Finely obervermiculate.
Size		34(37)40.

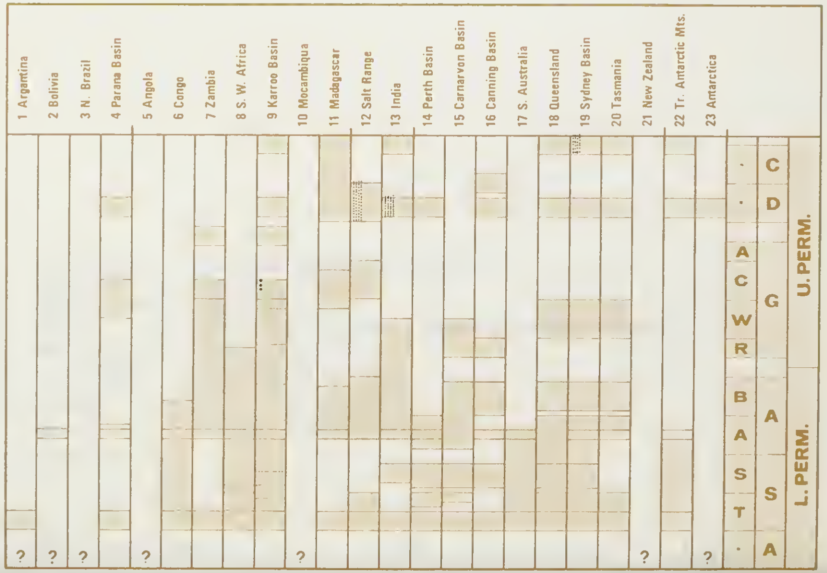
CLOSELY RELATED SPECIES

G.detritus	ꝎD; pl.79(42) - pl.79(4).

LITERATURE

9	Karroo Basin .	This paper, pl.79(42-49).
12	Salt Range . .	Balme '70, pl.6(7-9).
13	India	Bharad.'62, pl.5(82).
19	Sydney Basin .	Helby '70, pl.13(1-12,17-19).



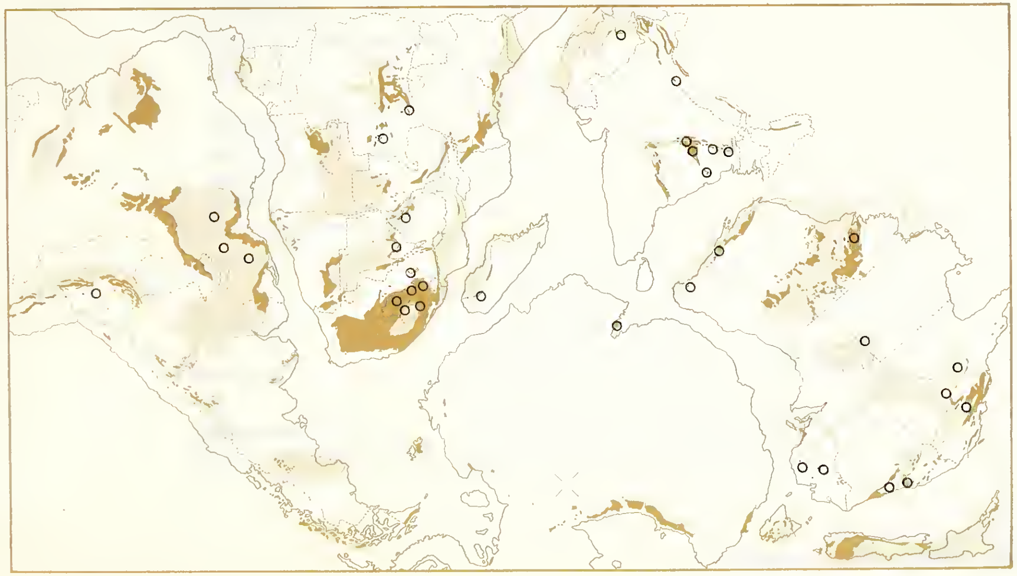


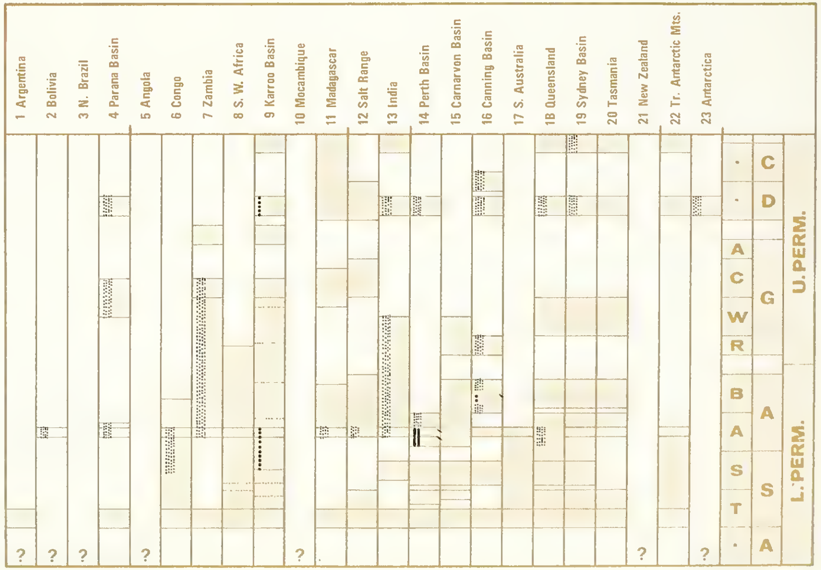
Laevigatosporites vulgaris Ibrahim'33

REFERENCE POPULATION	This paper, pl.80(1-6), 6 specimens.
REFERENCE LOCALITY	S.Africa, central Transvaal, Springbok Flats. Surface locality, HKr., M.Ecca.
HOLOTYPE TYPE LOCALITY	? I have not seen Ibrahim '33.
NAME DERIVATION	L. vulgaris = common, ordinary; (general appearance).
DESCRIPTION (ref. pop.)	
Shape **Contact faces** **Monolete mark** **Ornament.** Arrangement	as for genus.
Description	Levigate.
Size	56(79)102.
CLOSELY RELATED SPECIES	
L.striatus	Ⓓ; pl.80(1-6) - pl.81(1-32).

LITERATURE

2	Bolivia	Cousm.'65, pl.128(1-5), pl.130(11).
4	Parana Basin	Daem. & Quad.'70, pl.8(P-329), pl.9(P-289,A,B).
6	Congo	Pier.'59, pl.9(6); Kar & Bose'67, pl.4(1); Mahesh. & Bose'69, pl.4(9,10).
7	Zambia	Falc.'72, pl.3(20).
9	Karroo Basin	This paper, pl.80(1-13); (Hart'66b).
11	Madagascar	Rakoto.'70, pl.11(1-9).
12	Salt Range	Virkki'46, pl.3(34); Venk. & Kar'68b, pl.1(17,18); Lak. et. al.'60, pl.1(4,5).
13	India	Bharad.'62, pl.4(72-74), pl.5(75,76); Bharad. & Sal.'64, pl.3(63,64); Bharad. & Tiw.'64b, pl.1(17); Tiw.'65, pl.3(61); Nav.'66, pl.2(20); Bharad.'66, pl.3(36); Kar'66, pl.1(11); Mahesh.'67, pl.1(14); Nav. & Tiw.'68, pl.1(7); Venk. & Kar'68a, pl.2(45-50), pl.3(52-63); Kar'68a, pl.1(27-30); Tiw.'68, pl.2(28-29); Venk. & Kar'68c, pl.1(7,9); Kar'69b, pl.1(8,9,19-21); Sinha'72, pl.2(29).
	Australia	Balme & Henn.'56a, pl.1(1-5); Balme'64, pl.3(7).
14	Perth Basin	Segr.'70, pl.10(F), pl.11(A-D); Segr.'72, pl.4(2); Glick.'72, pl.8(17-18).
16	Canning Basin	Balme'73, pl.2(10), pl.4(10); (Balme'68).
17	S.Australia	(Evans'64b; Doug.'69).
18	Queensland	(Evans'64a,c,'66a,b,c,'67a; Burg.'70).
19	Sydney Basin	Helby'70, pl.25(36); (Evans'67b).
23	Antarctica	Balme & Playf.'67, pl.1(7).





Laevigatosporites striatus (Sal.'65) comb. nov.

Latosporites striatus Sal.'65

REFERENCE POPULATION .	This paper, pl.81(1-32), 32 specimens.
REFERENCE LOCALITY .	S.Africa, central Transvaal, Springbok Flats. Surface locality, HKr., M.Ecca.
HOLOTYPE	(Incorrectly designated by Sal '65); here designated; Sal '65, pl.1(19), p.230.
TYPE LOCALITY	India, East Raniganj Coalfield. Jaipuria Kajora Colliery, seam IX (U.Kajora), Raniganj Stage.
NAME DERIVATION . . .	L. striatus = striated; (ornamentation).

DESCRIPTION (Ref. pop.)

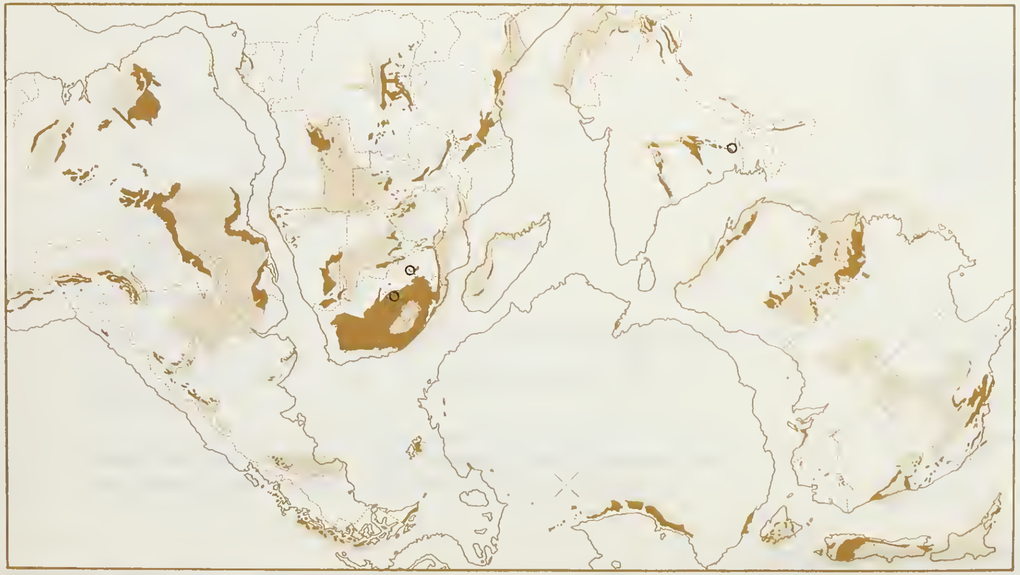
Shape	as for genus.
Contact faces	as for genus.
Monolete mark	as for genus.
Ornament. Arrangement	as for genus.
Description .	Coarse longitudinal to oblique ridges.
Size	52(71)90.

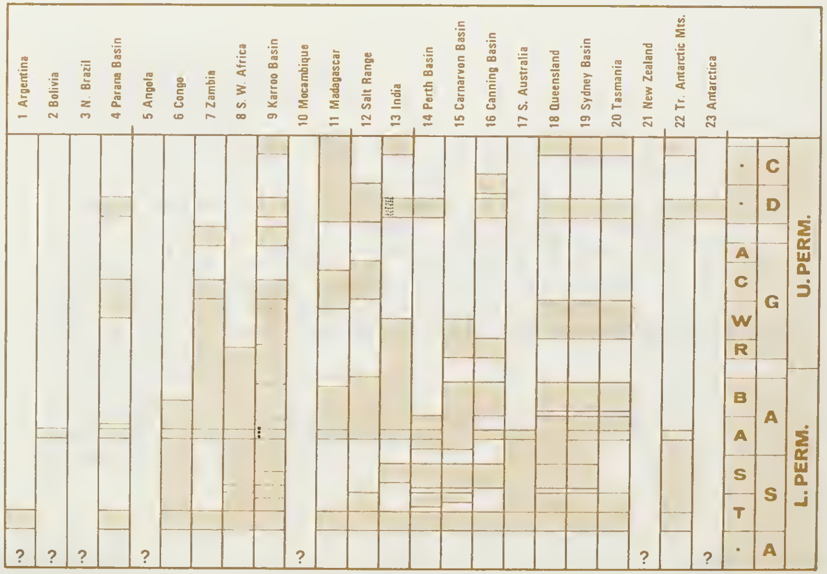
CLOSELY RELATED SPECIES

L.vulgaris	Ø ; pl.81(1-32) - pl.80(1-6).
L.varistriatus	OO; pl.81(1) - pl.80(17).

LITERATURE

9	Karroo Basin .	This paper, pl.80(14,15), pl.81(1-32).
13	India	Bharad.'62, pl.4(74), pl.5(76); Sal.'65, pl.1(19).



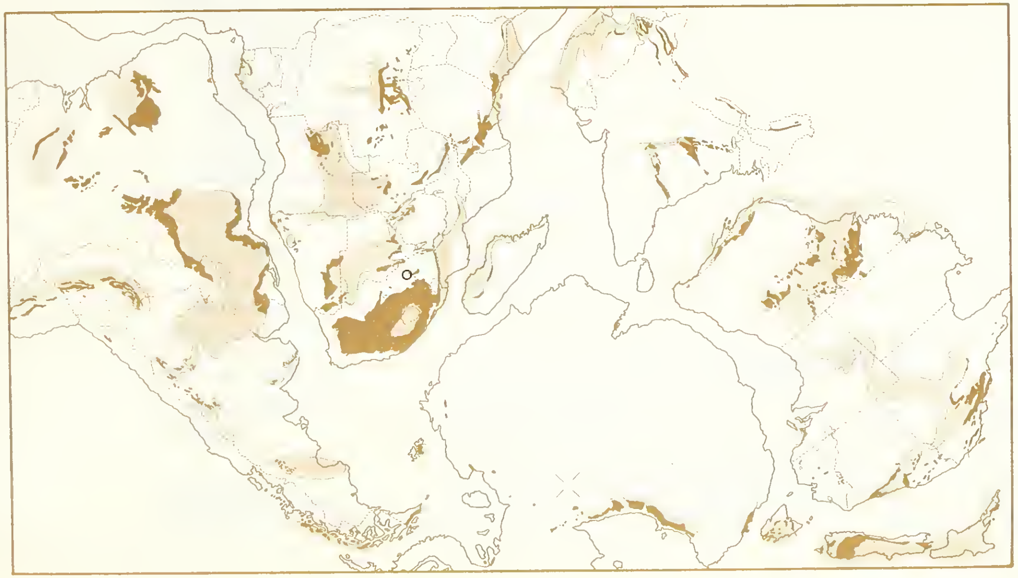


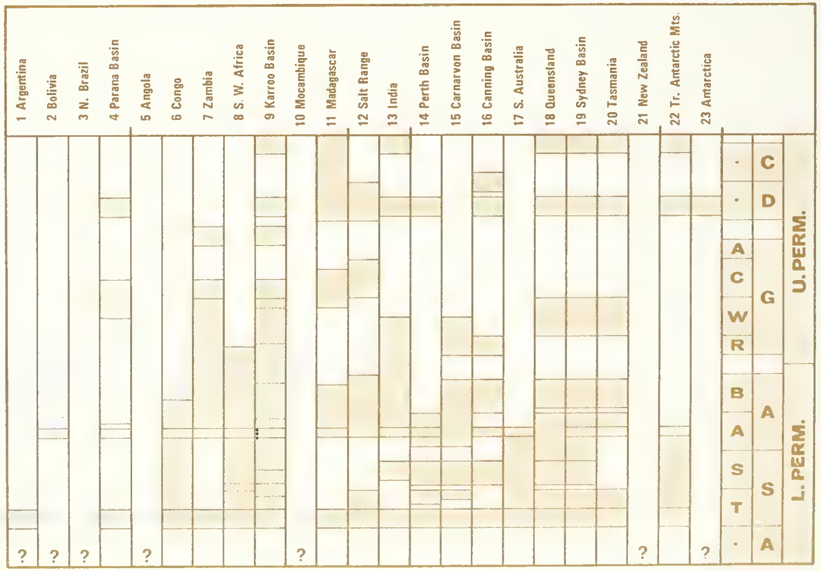
Laevigatosporites varistriatus sp. nov.

REFERENCE POPULATION .	This paper, pl.80(16-22), 7 specimens.
REFERENCE LOCALITY .	S.Africa, central Transvaal, Springbok Flats. Surface locality, HKr., M.Ecca.
HOLOTYPE	This paper, pl.80(21).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION . . .	L. varius = various; L. striatus = striated; (ornamentation).
DESCRIPTION (ref. pop.)	
Shape	as for genus.
Contact faces	as for genus.
Monolete mark	as for genus.
Ornament. Arrangement	as for genus.
Description .	Coarse longitudinal to oblique ridges + fine transverse ridges.
Size	58(67)76.
CLOSELY RELATED SPECIES	
L.striatus	OO. pl.80(17) - pl.81(1).

LITERATURE

9	Karroo Basin .	This paper, pl.80(16-22).





Vestigisporites ventrisaccatus sp. nov.

REFERENCE POPULATION	.	This paper, pl.82(1-27), 27 specimens.
REFERENCE LOCALITY	.	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1000' to 1019', M.Ecca equivalent.
HOLOTYPE	. . . . . .	This paper, pl.82(14).
TYPE LOCALITY	. . . .	As for reference locality.
NAME DERIVATION	. . .	L. ventri = ventral; L. saccata = sacks; (bladder attachment).

DESCRIPTION (ref. pop.)

Overall grain

Size	. . . . . .	50 (90) 130.
Shape	. . . . .	Elongately oval.
Y-mark	. . . . .	Monolete.
a:b	. . . . . .	2:10
Bladder attachment	.	Displaced strongly ventrally.

Exoexine (Outer sheath)

Texture	. . . . .	Coarse.
Radial pleating	. . .	Medium.

Intexine (Inner body)

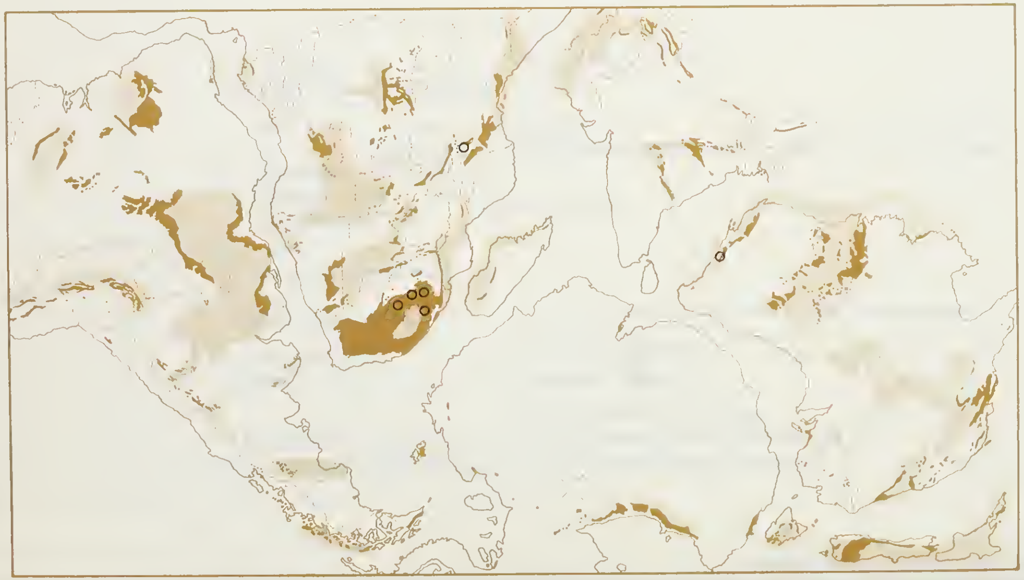
Dehiscence	. . . .	None.
Folding	. . . . .	Weak.
Ornamentation	. . .	Levigate.

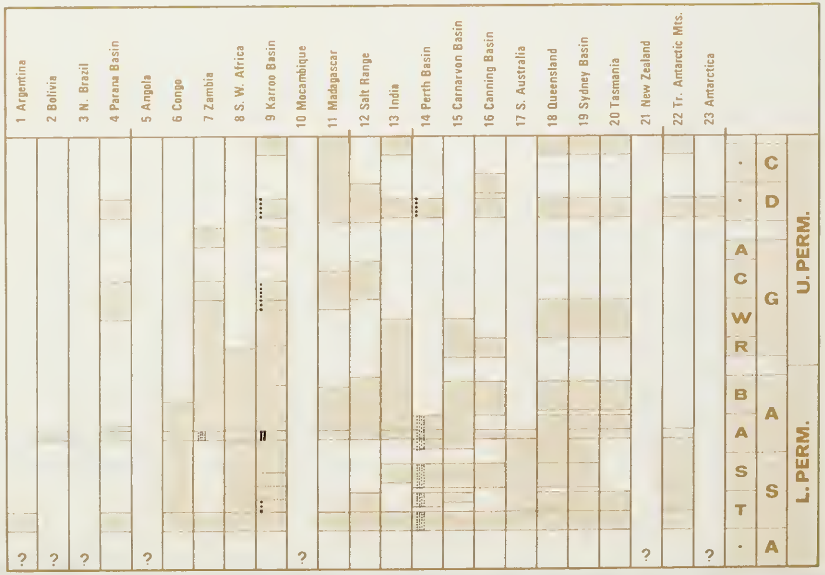
CLOSELY RELATED SPECIES

V.rudis . . . . ꝏ; pl.82(19) - pl.84(27).

LITERATURE

7	Zambia . . .	Hart '60, pl.2(26).
9	Karroo Basin .	This paper, pl.82,83 in full.
14	Perth Basin . .	Segr.'69, pl.8(A-D).





Vestigisporites rudis Balme & Henn.'55

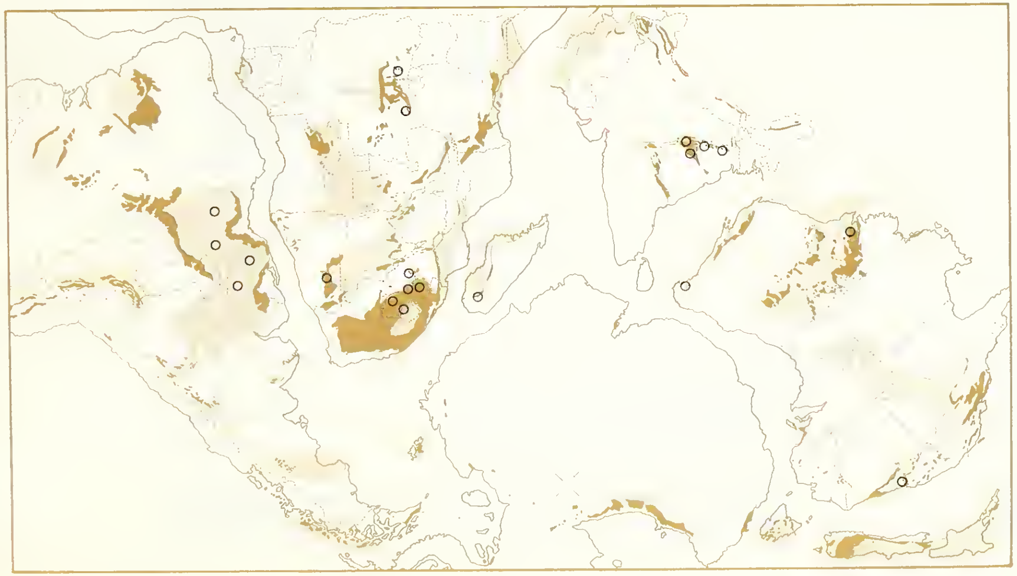
REFERENCE POPULATION	This paper, pl.84(1-40), 40 specimens.
REFERENCE LOCALITY	S.Africa, central Transvaal, Springbok Flats. Surface locality, HKr., M.Ecca.
HOLOTYPE	Not designated to date.
TYPE LOCALITY	N.S.W., Sydney Basin. Hebburn No.2 Colliery, Greta Seam, Greta Coal Measures.
NAME DERIVATION	L. rudis = raw, rough, rudimentary; (? relevance).
DESCRIPTION (ref. pop.)	
Overall grain	
Size	52(76) 100.
Shape	Elongately oval.
Y-mark	Monolete.
a:b	1:10.
Bladder attachment	?.
Exoexine (Outer sheath)	
Texture	Coarse.
Radial pleating	Medium.
Intexine (Inner body)	
Dehiscence	None.
Folding	Medium.
Ornamentation	Intrareticulate.

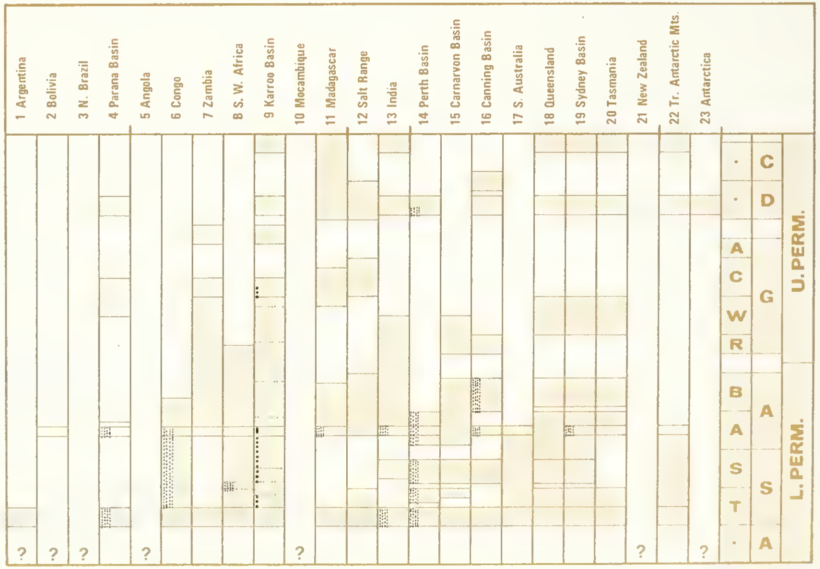
CLOSELY RELATED SPECIES

V.ventrisaccatus	ꝏ ; pl.84(27) - pl.82(19).
V.gracilis	ꝏ ; pl.84(22) - pl.85(28).
V.balmei	ꝏ ; pl.84(2) - pl.87(29).

LITERATURE:

4	Parana Basin	Daem. & Quad.'70, pl.2(P-451,P-417), pl.4(P-450,A,B), pl.5(P-430,A,B), pl.6(P-390,A-C).
6	Congo	Bose & Kar'66, pl.25(4,5); Kar & Bose'67, pl.8(3); Bose & Mahesh.'68, pl.15(4,6,7).
8	S.W.Africa	Lesch.'59, pl.4(30).
9	Karroo Basin	This paper, pl.84(1-40).
11	Madagascar	Rakoto.'70, pl.16(8,9).
13	India	Virk.'46, pl.8(121); Tiw.'65, pl.8(167-170); Saks.'71, pl.4(43,44), pl.5(56-59), pl.6(66); Lele & Karim'71, pl.2(21-23), pl.3(28,29).
	Australia	Balme'64, pl.3(18).
14	Perth Basin	Glick.'72, pl.32(1-6).
16	Canning Basin	Balme'73, pl.3(17), pl.5(11).
19	Sydney Basin	Balme & Henn.'55, pl.6(54,59,61,63).





Vestigisporites gracilis (Segr.'69) comb. nov.

Alisporites gracilis Segr.'69

REFERENCE POPULATION	This paper, pl.85,86 in full, 38 specimens.
REFERENCE LOCALITY	S.Africa, central Transvaal, Springbok Flats. Surface locality, HKr., M.Ecca.
HOLOTYPE	Original designation, Segr.'69, pl.6(H), p.191.
TYPE LOCALITY	W.Australia, Perth Basin, Indarra District. Borehole, 47¼ Mile Bore, 1418', 'Artinskian'.
NAME DERIVATION	L. gracilis = gracile, delicate; (general appearance).

DESCRIPTION (ref. pop.)

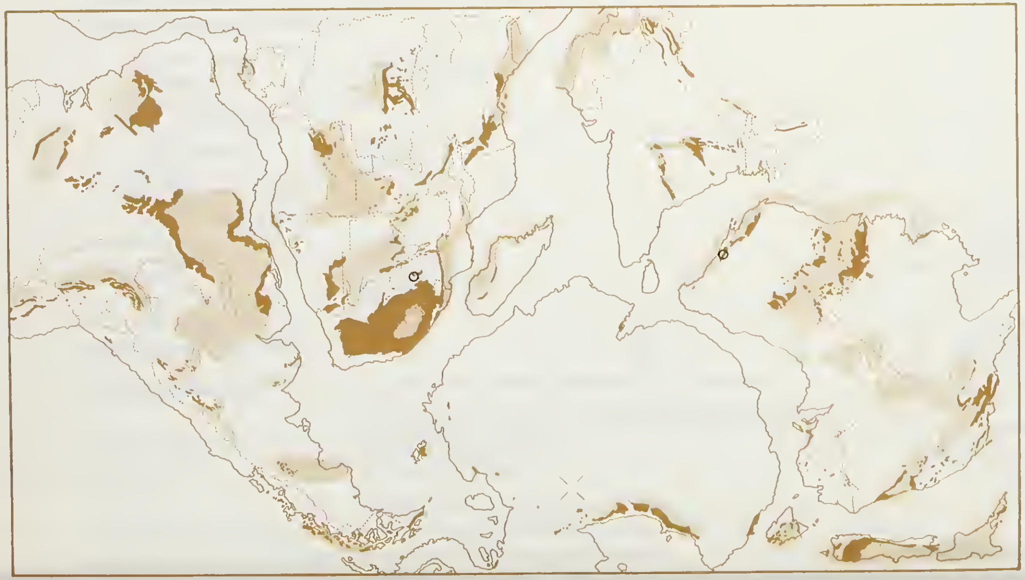
Overall grain	
Size	50(82)114.
Shape	Elongately oval.
Y-mark	Monolete.
a:b	3:10.
Bladder attachment	? .
Exoexine (Outer sheath)	
Texture	Coarse.
Radial pleating	Weak.
Intexine (Inner body)	
Dehiscence	None.
Folding	Strong.
Ornamentation	Levigate.

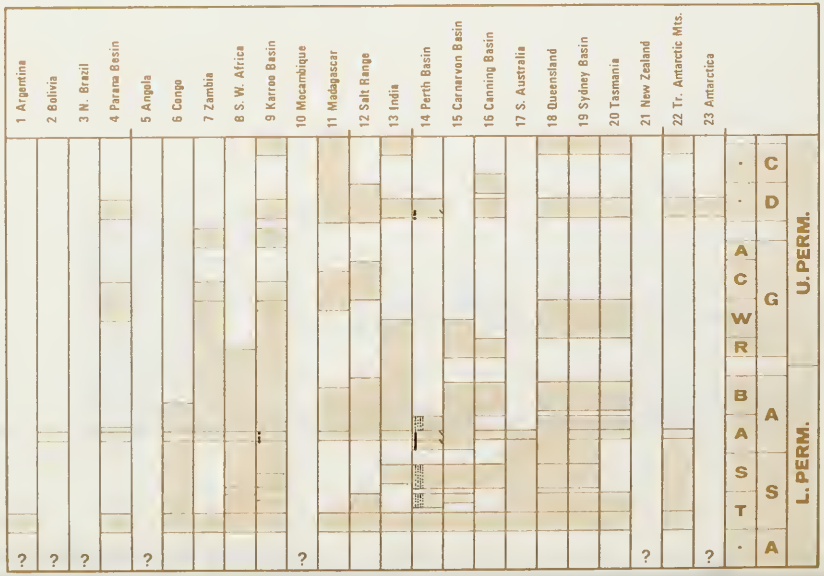
CLOSELY RELATED SPECIES

V.rudis	ꝏ; pl.85(28) - pl.84(22).

LITERATURE

9	Karroo Basin	This paper, pl.85,86 in full.
14	Perth Basin	Segr.'69, pl.6(H-J).





Vestigisporites balmei Hart'60

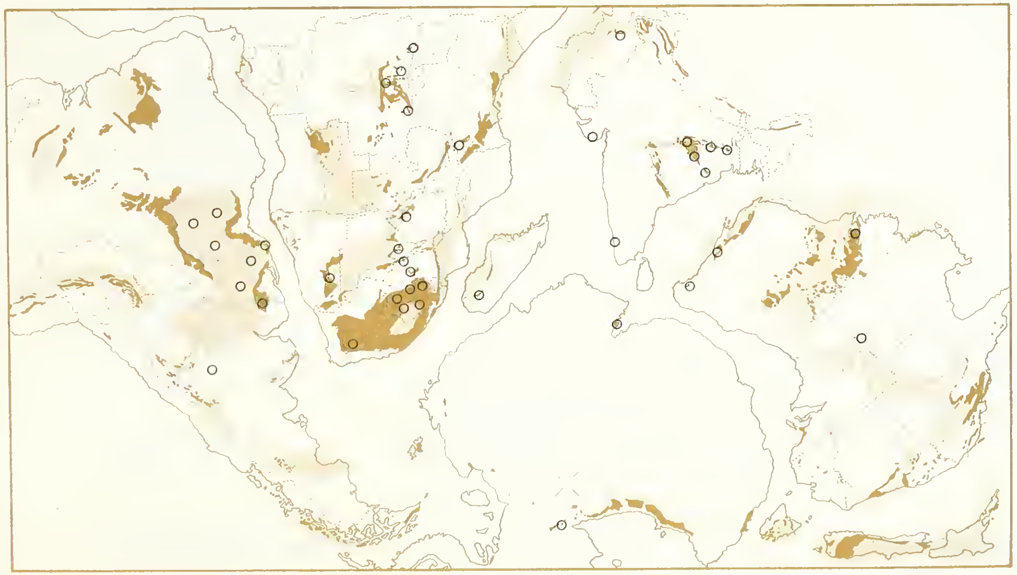
REFERENCE POPULATION	This paper, pl.87-95 in full, 181 specimens.
REFERENCE LOCALITY	S.Africa, central Transvaal, Springbok Flats. Surface locality, HKr, M.Ecca.
HOLOTYPE	Original designation, Hart'60, pl.2(21), p.14.
TYPE LOCALITY	Tanzania, Ruhuhu Valley. Surface locality, Ketewaka-Mchuchuma Coalfield, K2 Coal M.
NAME DERIVATION	After Dr. B.E. Balme, palynologist.
DESCRIPTION (ref. pop.)	
Overall grain	
Size	62(113)164.
Shape	Elongately oval.
Y-mark	Monolete.
a:b	4:10.
Bladder attachment	Symmetrical equatorial.
Exoexine (Outer sheath)	
Texture	Coarse.
Radial pleating	Strong.
Intexine (Inner body)	
Dehiscence	None.
Folding	Strong.
Ornamentation	Levigate.

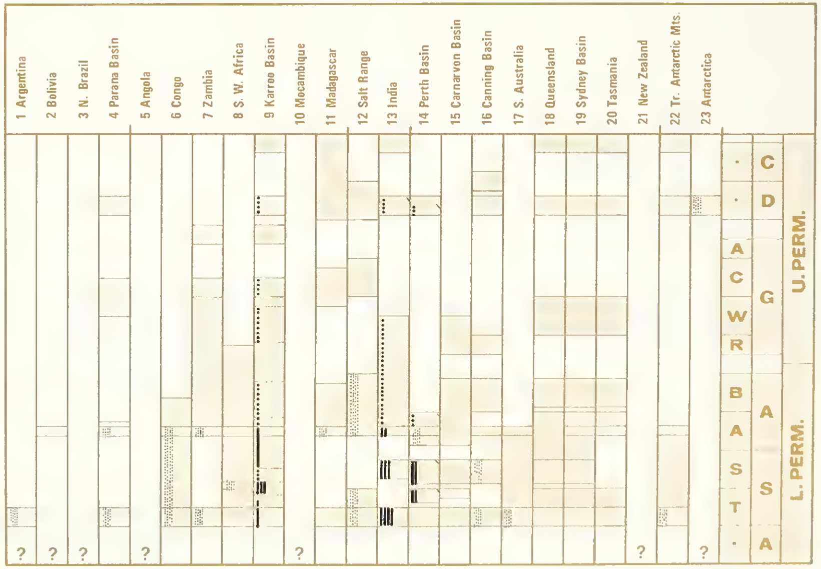
CLOSELY RELATED SPECIES

V.rudis	ꝏ; pl.87(29) - pl.84(2).
V.neglectus	ꝏ; pl.91(12) - pl.97(9).
V.karharbarensis	ꝏ; pl.94(4) - pl.105(2).

LITERATURE

1	Argentina	Menend.'69, pl.2(18,21); Menend.'71, pl.4(7), pl.5(1-6).
4	Parana Basin	Pant. & Sriv.'65, pl.1(24,27,28); Tiw. & Nav.'67, pl.2(31); Bharad.'69, pl.2(33-35); Daem. & Quad.'70, pl.1(P-500,A), pl.2(P-489,A,B,P-479,A), pl.3(P-479,A-C), pl.6(P-410,A-C).
6	Congo	Hoeg & Bose'60, pl.27(4,5); Bose & Kar'66, pl.2(4), pl.6(2-5), pl.10(1-3,6), pl.12(3-5), pl.17(9), pl.23(4-6), pl.24(8,9), pl.25(1,2,5,9), pl.26(4-10), pl.31(7,9), pl.32(1-3,6,7,9), pl.33(2), pl.34(2); Bose & Mahesh.'66, pl.5(3); Kar & Bose'67, pl.3(15), pl.4(5), pl.5(1-4,6-8), pl.6(2), pl.7(4,6,7), pl.9(13); Bose & Mahesh.'68, pl.9(3,5-7), pl.10(1-3,5), pl.11(2-5), pl.12(2-5), pl.13(1), pl.14(1,6), pl.16(3,4), pl.17(2,3); Mahesh. & Bose'69, pl.5(6-9), pl.6(1-6).
7	Zambia	Hart'60, pl.2(20,21); Falc.'72, pl.14(1-4,11), pl.14a(11,12).
8	S.W.Africa	Lesch.'59, pl.1(16), pl.2(20).
9	Karroo Basin	This paper, pl.87-95 in full; (Hart'66b).
11	Madagascar	Rakoto.'70, pl.15(3-5), pl.16(1,3,10).
12	Salt Range	Virk.'46, pl.2(16), pl.6(78,79); Venk. & Kar'68b, pl.2(20); Kemp (in press), pl.2(5,14).
13	India	Virk.'46, pl.12(152-154), pl.13(161); Pot. & Sah'60, pl.3(26,27); Pot. & Lele'61, pl.2(57,60,62,63), pl.3(82); Bharad.'62, pl.21(271); Bharad. & Tiw.'64a, pl.2(12,13); Tiw.'65, pl.4(73,84-86); Bharad. et al.'65, pl.2(13); Maithy'65, pl.4(26-29), pl.5(30,31), pl.6(41,44); Bharad.'66, pl.1(5,6), pl.2(19); Maithy'66, pl.3(20); Mahesh.'67, pl.5(39); Kar'68a, pl.2(45,46); Tiw.'68, pl.2(33,34); Venk.'70, pl.1(2); Sriv.'70, pl.2(16,17); Saks.'71, pl.4(47,49), pl.5(50-54); Lele & Karim'71, pl.1(12,13), pl.2(14,15,17-20,24), pl.3(25-27,30,31); Sinha'72, pl.2(33); Anand.'72, pl.2(13); Lele & Chand.'73, pl.1(1-8), pl.2(9-15).
	Australia	Balme'64, pl.3(17).
14	Perth Basin	Segr.'69, pl.1(A-C), pl.3(A); Glick.'72, pl.5(3,6), pl.32(9-11).
16	Canning Basin	Balme'73, pl.6(9), pl.8(11).
17	S.Australia	Evans'64b, pl.8(52,55,59), pl.9(60).
22	Tr.Antarctic Mts.	Kemp (in press), pl.2(21,23,24).
23	Antarctica	Balme & Playf.'67, pl.1(13).





Vestigisporites neglectus (Pot. & Lele'61) comb. nov.

Potonieisporites neglectus Pot. & Lele'61

REFERENCE POPULATION .	This paper, pl.96-98 in full, 28 specimens.
REFERENCE LOCALITY .	S.Africa, central Transvaal, Springbok Flats. Surface locality, Hkr., M.Ecca.
HOLOTYPE	Original designation, Pot. & Lele'61, pl.3(64), p.30.
TYPE LOCALITY	India, South Rewa Basin. Surface locality, Goraia, Talchir Fm.
NAME DERIVATION . . .	L. neglectus = neglected; (? relevance).

DESCRIPTION (ref. pop.)

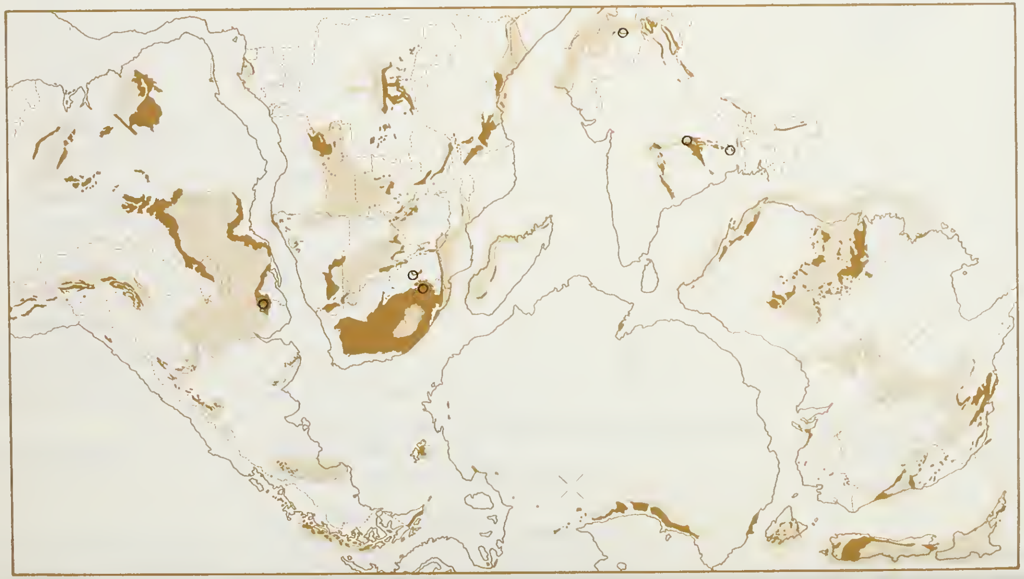
Overall grain	
Size	132 (160) 188.
Shape	Broadly oval.
Y-mark	Monolete/trilete.
a:b	10:10.
Bladder attachment .	?
Exoexine (Outer sheath)	
Texture	Coarse.
Radial pleating . . .	Weak.
Intexine (Inner body)	
Dehiscence	None.
Folding	Strong.
Ornamentation . . .	Levigate.

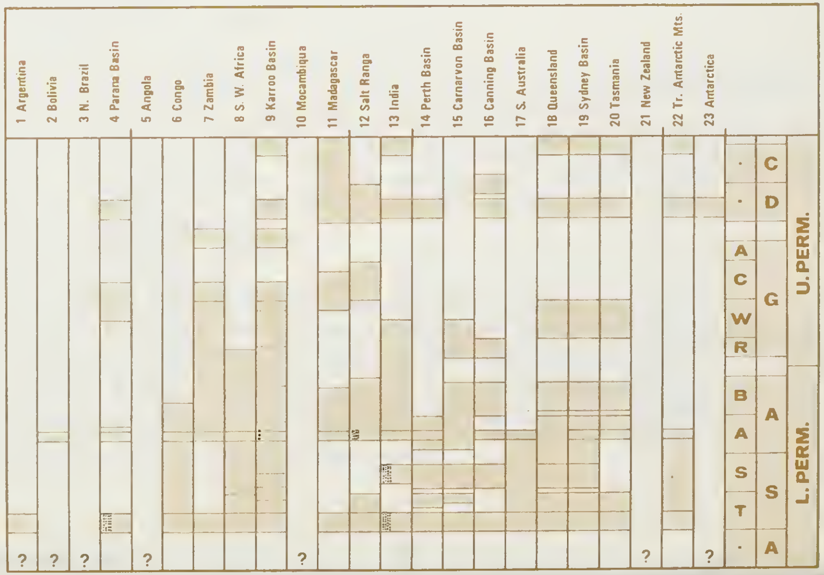
CLOSELY RELATED SPECIES

V.balmei	ꝏ; pl.97(9) - pl.91(12).
V.gondwanensis	ꝏ; pl.97(6) - pl.109(8).

LITERATURE

4	Parana Basin . .	Bharad.'69, pl.2(32).
9	Karroo Basin .	This paper, pl.96-98 in full.
12	Salt Range . .	Virk.'46, pl.5(49).
13	India	Virk.'46, pl.10(130,131,134-136), pl.11(137-139); Pot. & Lele'61, pl.2(61), pl.3(64,65); Maithy'65, pl.2(10), pl.4(24,25); Saks.'71, pl.4(41,46), pl.6(61); Lele & Karim'71, pl.2(16).





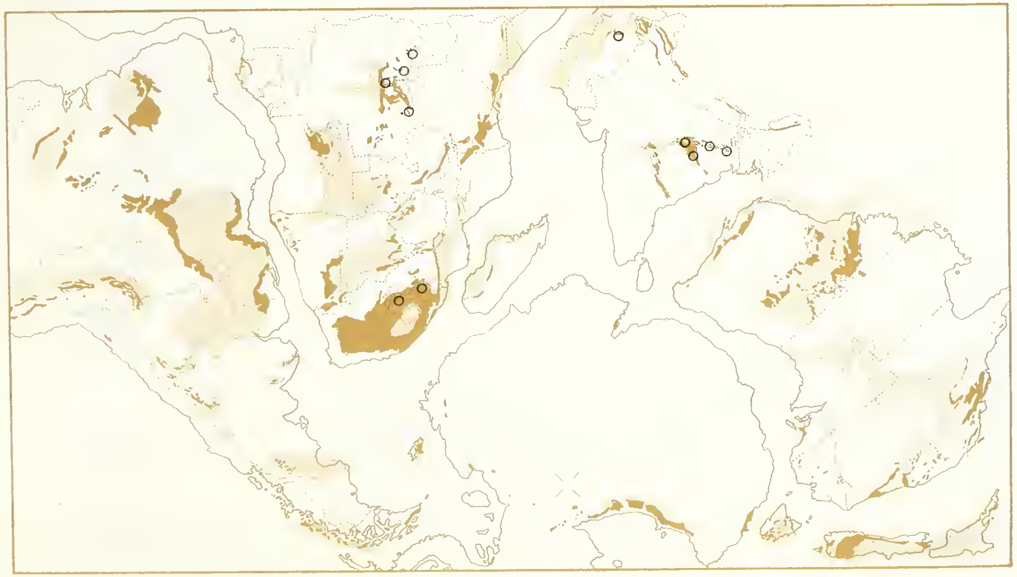
Vestigisporites walikalensis (Hoeg & Bose'60) comb. nov.

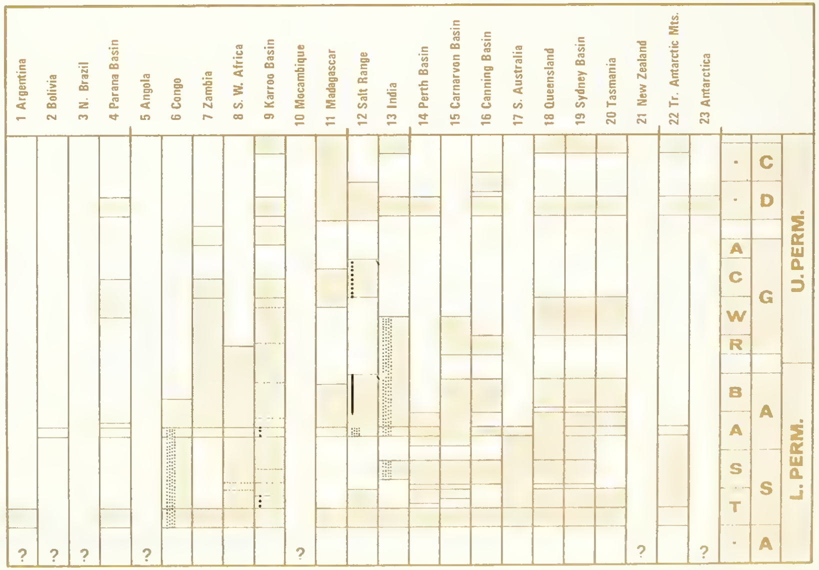
Florinites walikalensis Hoeg & Bose '60

REFERENCE POPULATION	This paper, pl.99(1-10), pl.100(1-3), 15 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, OW, 1145', M.Ecca equivalent.
HOLOTYPE	Original Designation, Hoeg & Bose '60, pl.29(2), p.25.
TYPE LOCALITY	Congo, Walikale region. Surface locality, Bavilevile, Assise des schistes noirs de Walikale,
NAME DERIVATION	After Walikale village, Congo.
DESCRIPTION (ref. pop.)	
Overall grain	
Size	124(172)220.
Shape	Broadly oval.
Y-mark	Monolete/Trilete.(indistinct).
a:b	6:10.
Bladder attachment	? .
Exoexine (Outer sheath)	
Texture	Coarse.
Radial pleating	Weak.
Intexine (Inner body)	
Dehiscence	None.
Folding	Strong.
Ornamentation	Levigate.
CLOSELY RELATED SPECIES	
V.balmei	OO; pl.99(5) - pl.91(12).
V.magnus	OO; pl.99(5) - pl.97(10).

LITERATURE

6	Congo	Hoeg & Bose'60, pl.27(6), pl.29(2,3); Bose & Kar'66, pl.2(1), pl.7(2,3); Bose & Mahesh.'66, pl.3(3), pl.5(1); Kar & Bose'67, pl.4(2), pl.6(1); Bose & Mahesh.'68, pl.12(1), pl.13(2).
9	Karroo Basin	This paper, pl.99,100 in full.
12	Salt Range	Venk. & Kar'68b, pl.2(19), pl.3(31-33); Balme'70, pl.9(1,2).
13	India	Tiw.'65, pl.4(79-83), pl.5(92); Maithy'65, pl.2(11), pl.4(25); Maithy'66, pl.3(21); Mahesh.'67, pl.4(30-32); Kar'68a, pl.2(42).





Vestigisporites karharbarensis (Maithy'65) comb. nov.

Parasaccites karharbarensis Maithy '65

REFERENCE POPULATION .	This paper, pl.101-105 in full, 87 specimens.
REFERENCE LOCALITY .	S.Africa, central Transvaal, Springbok Flats. Surface locality, HKr., M.Ecca.
HOLOTYPE	Original designation, Maithy '65, pl.3(19), p.295.
TYPE LOCALITY	India, Bihar, Giridih Coalfield. Surface locality, Central pit, Srirampur Colliery, Karharbari Fm.
NAME DERIVATION . . .	After Karharbari Fm.

DESCRIPTION (ref. pop.)

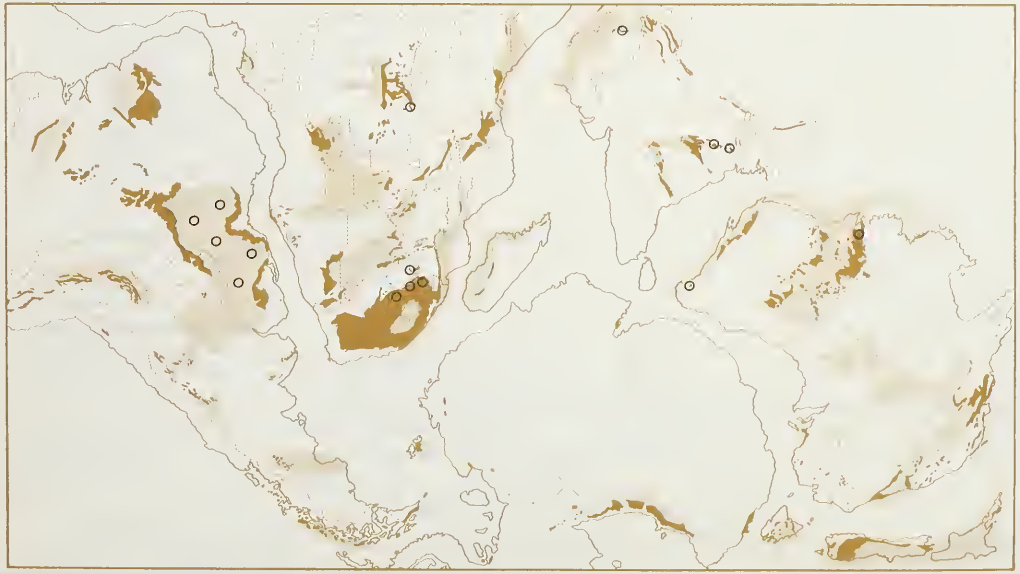
Overall grain	
Size	62(96)130.
Shape	Broadly oval.
Y-mark	Monolete/Trilete.
a:b	10:10.
Bladder attachment . .	Symmetrical equatorial.
Exoexine (Outer sheath)	
Texture	Coarse.
Radial pleating . . .	Strong.
Intexine (Inner body)	
Dehiscence	Weak.
Folding	Weak.
Ornamentation . . .	Levigate.

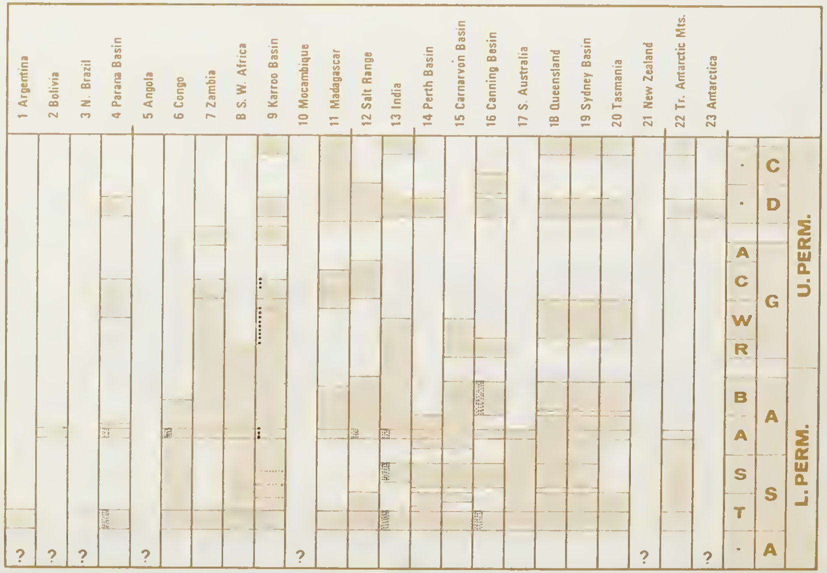
CLOSELY RELATED SPECIES

V.balmei	Φ ; pl.105(2) - pl.94(4).
V.gondwanensis	Φ ; pl.101(4) - pl.107(1).

LITERATURE

4	Parana Basin . .	Daem. & Quad.'70, pl.3(P-522B), pl.4(P-522, A-C).
6	Congo . . .	Bose & Mahesh.'68, pl.5(2).
9	Karroo Basin .	This paper, pl.101-106 in full.
12	Salt Range . .	Virk.'46, pl.4(45).
13	India	Virk.'46, pl.8(113,114); Maithy'65, pl.3(19,20), pl.4(23); Lele & Karim'71, pl.1(11).
14	Perth Basin . .	Glick.'72, pl.28(1).
16	Canning Basin .	Balme'73, pl.3(23), pl.8(12).





Vestigisporites gondwanensis (Balme & Henn.'56) comb. nov.

Nuskoisporites gondwanensis Balme & Henn.'56

REFERENCE POPULATION .	This paper 107 - 110 in full, 58 specimens.
REFERENCE LOCALITY .	S.Africa, Central Transvaal, Springbok Flats. Surface locality, HKr., M.Ecca.
HOLOTYPE	Not designated to date.
TYPE LOCALITY	N.S.W., Sydney Basin. Bloomfield Colliery, Big Ben seam, Tomago Coal Measures.
NAME DERIVATION . . .	After Gondwanaland.

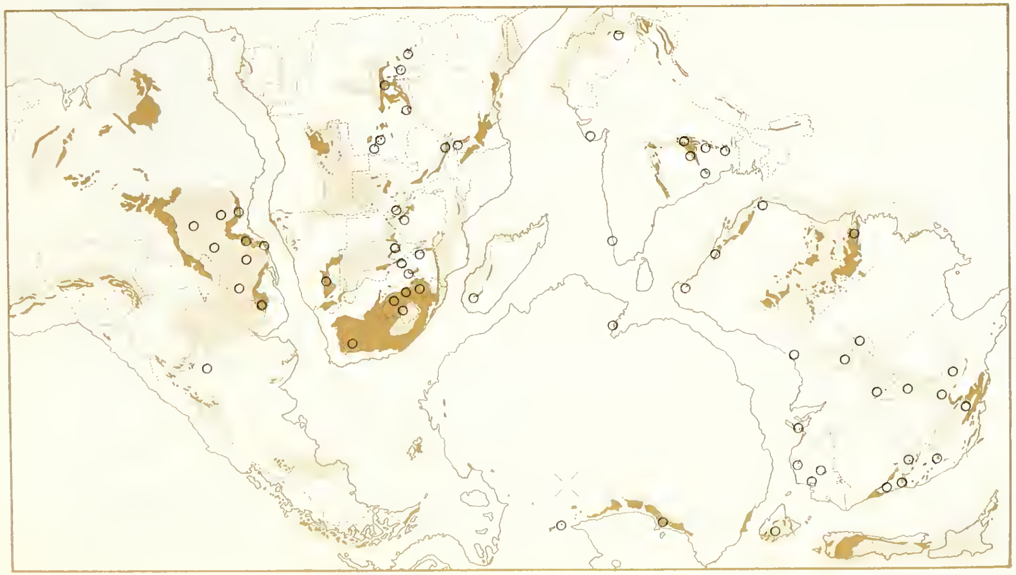
DESCRIPTION (ref. pop.)

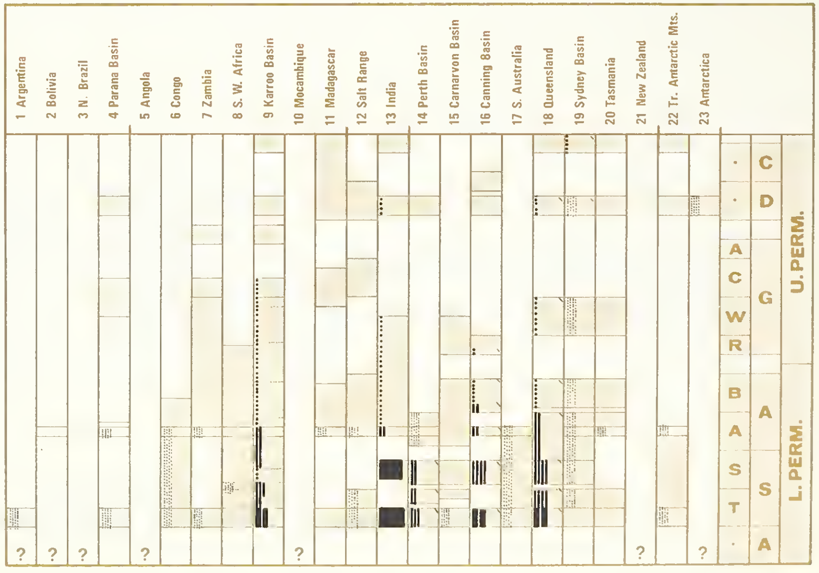
Overall grain	
Size	62(104)146.
Shape	Circular.
Y-mark	Trilete.
a:b	10:10.
Bladder attachment .	Displaced slightly dorsally.
Exoexine (Outer sheath)	
Texture	Coarse.
Radial pleating . . .	Strong.
Intexine (Inner body)	
Dehiscence	Weak.
Folding	Strong.
Ornamentation . . .	Levigate.

CLOSELY RELATED SPECIES

V.neglectus	ↀ; pl.109(8) - pl.97(6).
V.karharbarensis . . .	ↀ ; pl.107(1) - pl.101(4).
V.rotatus	ↀ ; pl.107(15) - pl.118(13).

1	Argentina . .	Menend.'69, pl.2(19,22); Menend.'71, pl.4(4-6).
4	Parana Basin . .	Pant. & Sriv.'65, pl.1(26); Tiw. & Nav.'67, pl.2(29); Bharad.'69, pl.1(29,31); Daem & Quad.'70, pl.1(P-490,P-501,A,B), pl.3(P-550 A-C, P-522A), pl.7(P-384,A,B,P-906,A,B,P-402); Kemp (in press), pl.1(30,31).
6	Congo . . .	Pier.'59, pl.7(1), pl.8(1,2); Hoeg. & Bose'60, pl.28(1-3), pl.29(1,6,7), pl.30(2,3), pl.32(1,2,4), pl.33(1-3); Bose & Kar'66, pl.1(9-12), pl.2(2,3), pl.3(3,5), pl.4(1-4), pl.20(5,6), pl.21(1,2), pl.23(2,3), pl.31(1,4); Bose & Mahesh.'66, pl.1(1-3); Kar & Bose'67, pl.3(13), pl.4(4), pl.6(3); Bose & Mahesh.'68, pl.4(22,23), pl.5(1,3,4-7), pl.6(1,2), pl.7(4,5), pl.8(2-6), pl.9(1,2); Mahesh. & Bose'69, pl.5(1-5); Mahesh.'69, pl.3(9,10); pl.4(1,2,4).
7	Zambia . . .	Hart'60, pl.2(31), pl.3(32); Falc.'72, pl.12(1-7), pl.13(1-12), pl.14a(1-8); (Utt.'70).
8	S.W.Africa . .	Lesch.'59, pl.1(15), pl.3(21,22), pl.4(25-27), pl.5(31).
9	Karroo Basin .	This paper, pl.107-112 in full; (Hart'66b).
11	Madagascar . .	Rakoto.'70, pl.8(1), pl.12(1-3,6-9). pl.13(2,4-10), pl.14(2-7), pl.15(1,2).
12	Salt Range . .	Virk.'39, pl.1(6-9); Virk.'46, pl.1(8,9), pl.2(10-15), pl.3(26-28), pl.4(46-48), pl.5(50-52); Venk. & Kar'68b, pl.2(22); Kemp (in press), pl.2(12,15).
13	India	Virk.'39, pl.1(10,11); Virk '46, pl.8(110-112,116,117), pl.11(140-146), pl.12(147-151); Sur. & Lele'56, pl.2(13); Pot. & Sah'60, pl.2(15-21), pl.3(22,23); Pot. & Lele'61, pl.1(37,38), pl.2(39-56,58,59); Bharad.'62, pl.5(95), pl.6(97,98); Bharad. & Tiw.'64b, pl.1(9,11,15), pl.2(7-11); Bharad. & Sal.'64, pl.3(70); Tiw.'65, pl.4(72,74-77), pl.5(87-90); Maithy'65, pl.1(6-9), pl.2(2-16); Bharad.'66, pl.1(7-9), pl.2(16,18); Maithy'66, pl.1(10), pl.2(11-13), pl.3(18,19); Bharad. & Tiw.'66,pl.1(8,9); Mahesh.'67, pl.2(24), pl.3(26-29); Nav. & Tiw.'67(pl.9(1-3); Kar.'68a, pl.1(33,35,36), pl.2(37-40,44,47,48); Tiw.'68, pl.2(30,31), pl.3(37); Lele & Maithy'69, pl.1(6-8,10,12); Venk.'70, pl.1(1,4,8); Sriv.'70, pl.1(7-10); Saks.'71, pl.2(25-34), pl.3(35-40); Lele & Karim'71, pl.1(6,7,10); Anand.'72, pl.1(6).
	Australia . . .	Balme & Henn.'56b, pl.6(62-65), pl.27(66,67); Balme'64, pl.3(14).
14	Perth Basin . .	Segr.'69, pl.1(D), pl.2(B); Glick.'72, pl.26(1-4), pl.27(1-6), pl.28(2,4), pl.29(1-3).
15	Carnarvon Basin .	(Balme'67).
16	Canning Basin .	Balme'73, pl.1(21), pl.4(16), pl.5(20), pl.6(10), pl.8(10,13); (Balme'68).
17	S.Australia . .	Virk.'39, pl.1(1-5); Virk.'46, pl.14(181-186); Pant. & Mehra'63, pl.2(F-H); Evans'64b, pl.4(34,36,37), pl.5(39,41,42), pl.6(45,46), pl.7(49,50,51), pl.8(53,54,56,57); (Har. & Lud.'66; Har. & McG.'68,'71; Doug.'69).
18	Queensland . .	Hill & Woods'63, pl.15(16); (Evans'64a,c,'66a,b,c,'67a; Pat.'65,'69; Burg.'70; Norv.'71).
19	Sydney Basin .	Dulh.'45, pl.7(34B); (Balme & Henn.'56b; Evans'67b; McK. & Gut.'69; Helby'70).
20	Tasmania . . .	(Balme & Henn.'56b).
22	Tr.Antarctic Mts.	Kemp (in press), pl.2(22); (Kyle'73 letter; Bar & Kyle (in press)).
23	Antarctica . .	Balme & Playf.'67, pl.2(7,8).





Vestigisporites rotatus (Balme & Henn.'56) comb. nov.

Nuskoisporites rotatus Balme & Henn.'56

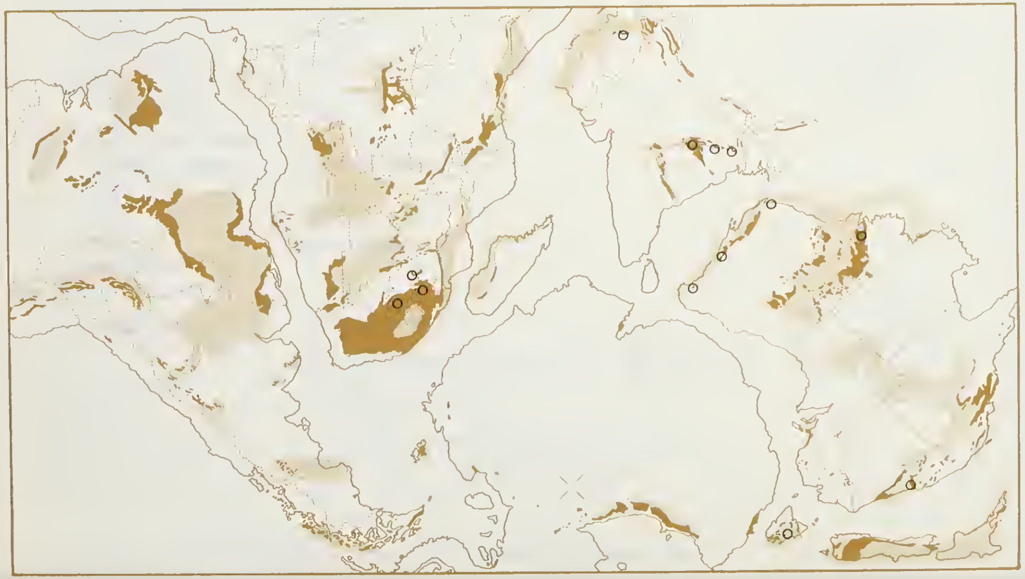
REFERENCE POPULATION	This paper, pl.113-119 in full, 134 specimens.
REFERENCE LOCALITY	S.Africa, central Transvaal, Springbok Flats. Surface locality, HKr., M.Ecca.
HOLOTYPE	Not designated to date.
TYPE LOCALITY	N.S.W., Sydney Basin. Hebburn No.2 Colliery, Main Greta seam, Greta Coal Measures.
NAME DERIVATION	L. rotatus = round, (equatorial outline).
DESCRIPTION (ref. pop.)	
Overall grain	
Size	52(94)136.
Shape	Very roundly triangular.
Y-mark	Trilete.
a:b	10:10.
Bladder attachment	Symmetrical, equatorial.
Exoexine (Outer sheath)	
Texture	Fine.
Radial pleating	Weak.
Intexine (Inner body)	
Dehiscence	Strong.
Folding	Strong.
Ornamentation	Intrareticulate to verrucate.

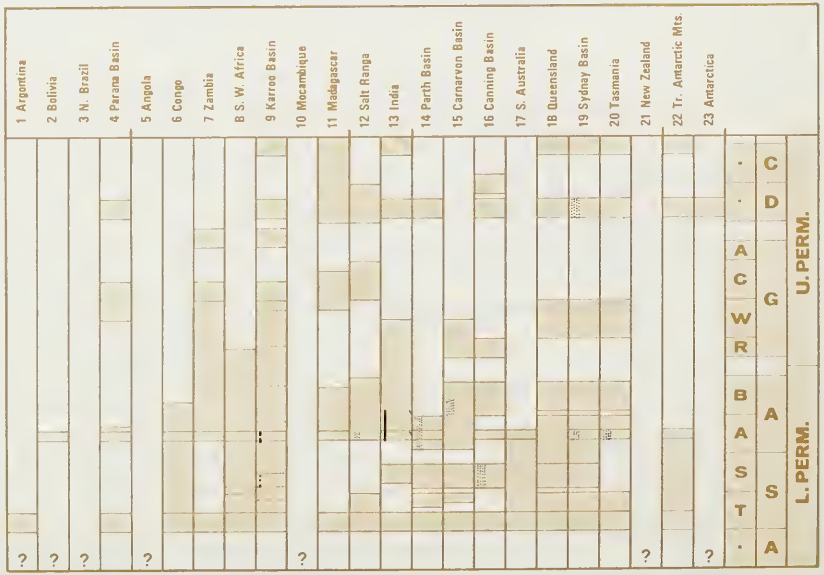
CLOSELY RELATED SPECIES

V.gondwanensis	OD ; pl.118(13) - pl.107(15).

LITERATURE

9	Karroo Basin	This paper, pl.113-120 in full.
12	Salt Range	Venk. & Kar'68b, pl.3(28-30).
13	India	Tiw.'65, pl.3(64-68); Mahesh.'67, pl.2(19); Sinha'72, pl.2(31,38), pl.3(40,41).
	Australia	Balme & Henn.'56b, pl 8(68-71).
14	Perth Basin	Segr.'69, pl.3(C); Glick.'72, pl.24(1,4), pl.29(4); (Balme & Henn.'56b).
15	Carnarvon Basin	(Balme'67).
16	Canning Basin	Balme'73, pl.6(11).
19	Sydney Basin	(Balme & Henn.'56b).
20	Tasmania	(Balme & Henn.'56b).





Vittatina circumsaccata sp. nov.

REFERENCE POPULATION .	This paper, pl.121(1-13), 10 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1131', L.Ecca equivalent.
HOLOTYPE	This paper, pl.121(2).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION . . .	L. circum = encircled; L. saccata = sacks; (equatorial bladder).

DESCRIPTION (ref. pop.)

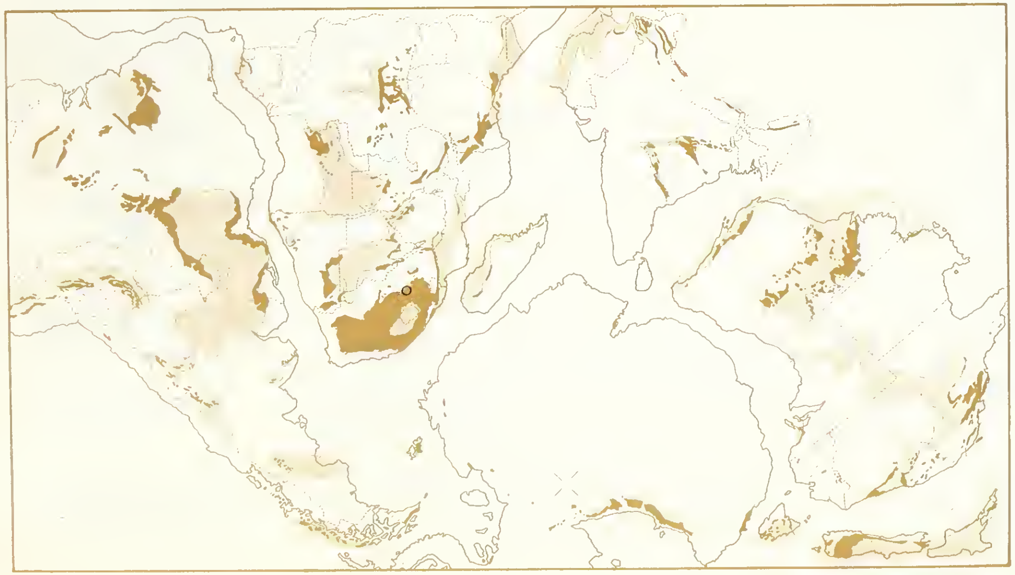
Overall grain	
Size	40(50)56.
Shape	Oval.
Y-mark	Monolete.
Exoexine (Outer sheath)	
Cappa -dorsal . . .	Strongly intrareticulate; partially defined longitudinal ribs (9 per 20mu).
-ventral . . .	Restricted to dorsal surface.
Cappula	All of ventral surface excluding part occupied by saccus.
Sacci	Monosaccate.
Intexine (Inner body)	
Corpus -shape . . .	as for genus.
-preserv. . . .	Never lost.

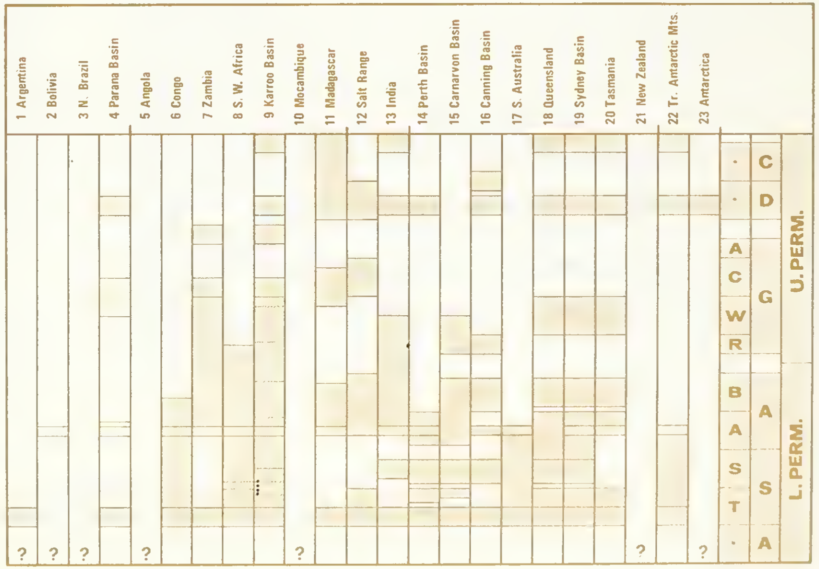
CLOSELY RELATED SPECIES

V.multistriata	OO; pl.121(11) - pl.122(17).

LITERATURE

9	Karroo Basin .	This paper, pl.121(1-13).





Vittatina multistriata (Balme & Henn.'55) comb. nov.

Lueckisporites multistriatus Balme & Henn.'55

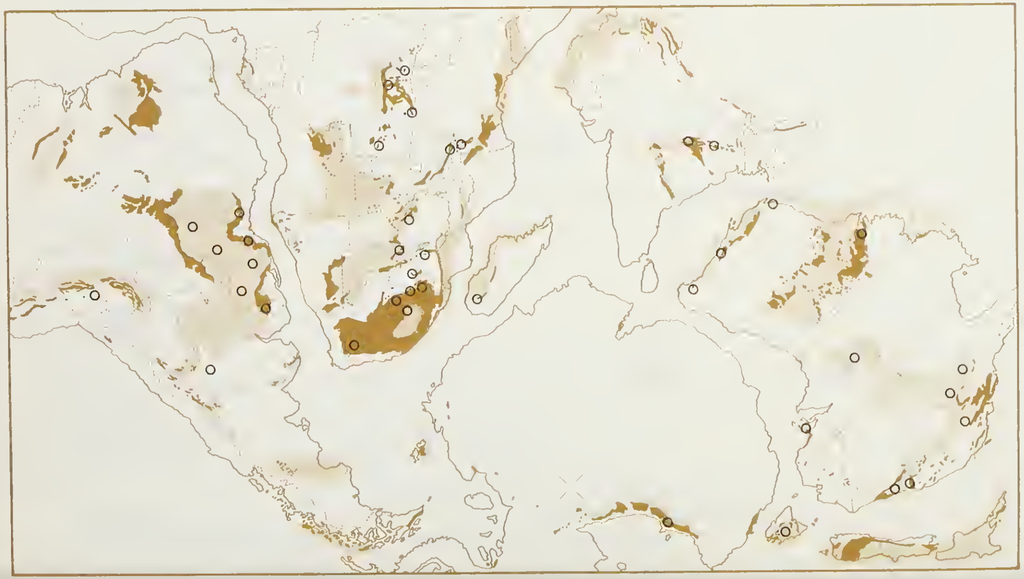
REFERENCE POPULATION .	This paper, pl.125(1-30), pl.126(1-11), 41 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, OW, 1145', M.Ecca equivalent.
HOLOTYPE	Not designated to date.
TYPE LOCALITY	N.S.W., Sydney Basin. Borehole, South Wallarah No.3, seam at 679', Newcastle C.M.
NAME DERIVATION . . .	L. multus = many; L. striata = striated; (striated cappa).
DESCRIPTION (ref. pop.)	
Overall grain	
Size	52(74) 116.
Shape	Elongate oval.
Y-mark	Monolete.
Exoexine (Outer sheath)	
Cappa -dorsal	Weakly intrareticulate; clearly defined longitudinal ribs (9 per 20 mu).
-ventral . . .	Restricted to dorsal surface.
Cappula	All of ventral surface excluding part occupied by sacci.
Sacci	Disaccate.
Intexine (Inner body)	
Corpus -shape . . .	as for genus.
-preserv. . . .	Never lost.

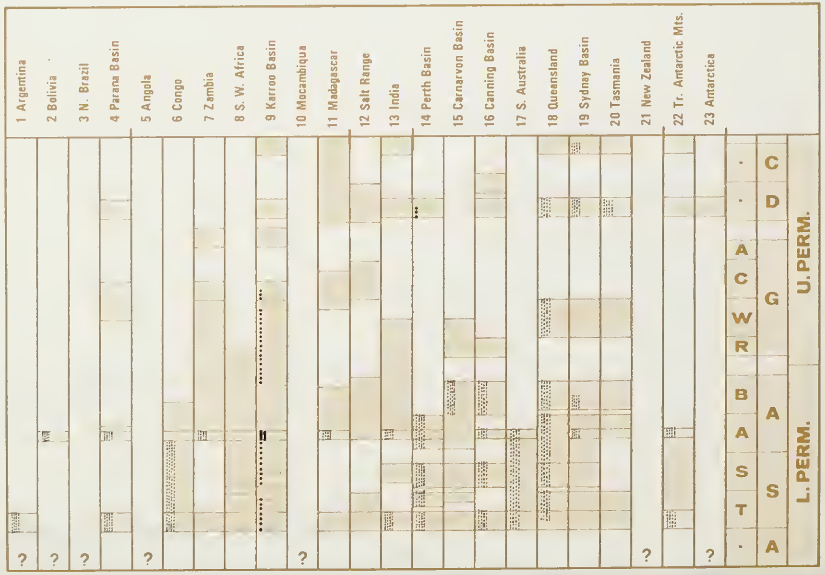
CLOSELY RELATED SPECIES

V.nonsaccata	⦶ ;	pl.125(1-30), pl.126(1-11) - pl.126(12-23).
V.simplex	OO;	pl.121(30) - pl.128(1).
V.fasciolata	ꝏ ;	pl.123(5) - pl.133(46).

LITERATURE:

1	Argentina . . .	Menend.'69, pl.2(15); Menend.'71, pl 6(3-5).
2	Bolivia . . .	Cous.'65, pl.129(11).
4	Parana Basin . .	Bharad.'69, pl.2(40-42); Daem. & Quad.'70, pl.7(P-386,P-391); Kemp (in press), pl.1(22,23).
6	Congo . . .	Bose & Kar'66, pl.17(7), pl.28(4,5,19-21); Kar & Bose'67, pl.11(1); Mahesh.'69, pl.5(5,8-10).
7	Zambia . . .	Hart'60, pl.1(1,2,13); Falc.'72, pl.6(12-17); (Utt.'70).
9	Karroo Basin .	This paper, pl.121(14-36), pl.122-125 in full, pl.126(1-11); (Hart'66b).
11	Madagascar . .	Rakoto.'70, pl.21(9).
13	India	Pot. & Lele'61, pl.3(73); Tiw.'65, pl.6(117,118), pl.9(198,199,204).
	Australia . . .	Balme & Henn.'55, pl.2(16-20); Balme'64, pl.4(9).
14	Perth Basin . .	Segr.'69, pl.11(A-C), pl.12(C-E); Glick.'72, pl.40(1-10).
15	Carnarvon Basin .	(Balme'67).
16	Canning Basin .	Balme'73, pl.3(15), pl.4(14), pl.5(13), pl.6(3), pl.8(?).
17	S.Australia . .	(Har. & McG.'67,71).
18	Queensland . .	(Evans'64a,c,'66a,b,c,'67a; Burg.'70; deJers.'70; Norv.'71; Rig.'73).
19	Sydney Basin .	Dulh.'45, pl.7(40D); Helby'70, pl.37(18-21); (Balme & Henn.'55, Evans'67b).
20	Tasmania . . .	(Banks & Naqvi'67).
22	Tr.Antarctic Mts.	(Kyle'73 letter; Bar. & Kyle (in press)).





Vittatina nonsaccata sp.nov.

REFERENCE POPULATION .	This paper, pl.126(12-23), 12 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, OW, 1145', M.Ecca equivalent.
HOLOTYPE	This paper, pl.126(20).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION . . .	L. non = not; L. saccata = with sacks; (non saccate).

DESCRIPTION (ref. pop.)

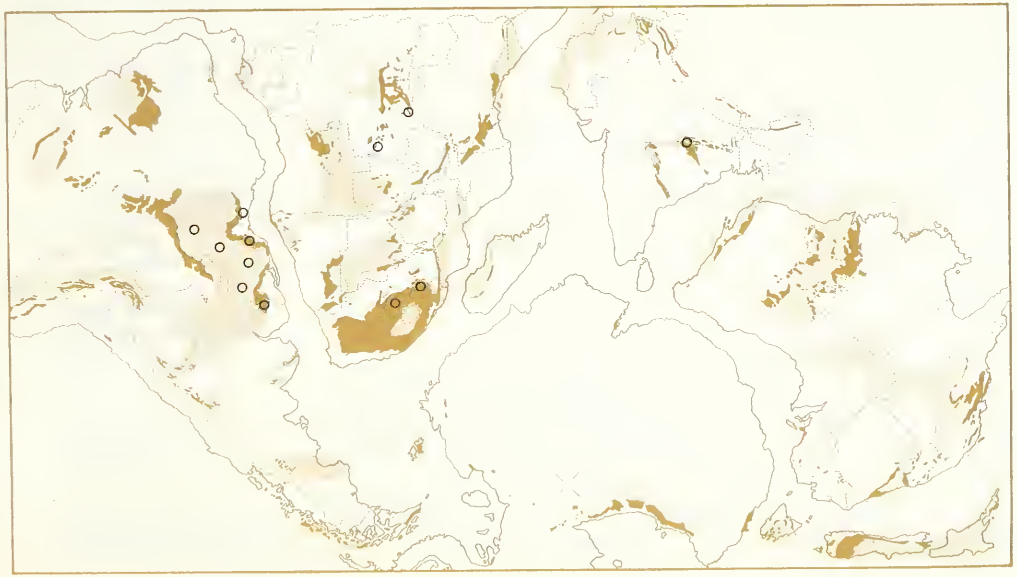
Overall grain	
Size	48(70)74.
Shape	Oval.
Y-mark	Monolete.
Exoexine (Outer sheath)	
Cappa -dorsal . . .	Very weakly intrareticulate; clearly defined longitudinal ribs (6 per 20mu).
-ventral . . .	Restricted to dorsal surface.
Cappula	All of ventral surface.
Sacci	Non-saccate
Intexine (Inner body)	
Corpus -shape . . .	as for genus.
-preserv. . . .	Never lost.

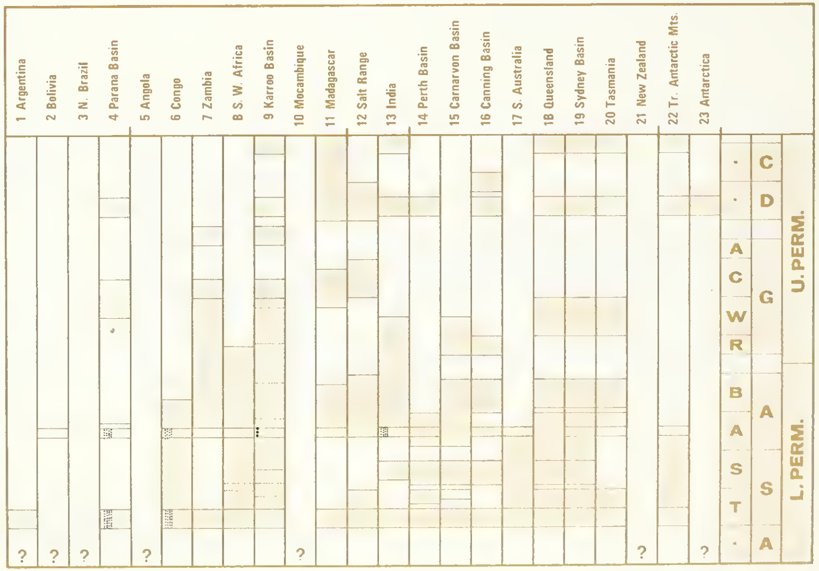
CLOSELY RELATED SPECIES

V.multistriata	0 ; pl.126(12-23) - pl.125(1-30), pl.126(1-11).
V.simplex	OO; pl.127(1-7) - pl.128(1-13).

LITERATURE

4	Parana Basin . .	Bharad.'69, pl.2(43-46); Daem. & Quad.'70, pl.7(P,385,B); Kemp (in press), pl.1(25).
6	Congo . . .	Mahesh. & Bose'69, pl.8(10); Mahesh.'69, pl.5(11), pl.6(1,2).
9	Karroo Basin .	This paper, pl.126(12-13).
13	India	Sinha '72, pl.8(121).





Vittatina simplex (Tiw.'65) comb. nov.

Welwitschiapites simplex Tiw.'65

REFERENCE POPULATION	This paper, pl.128(1-13), 11 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Greylingstad/Bethal/Hendrina area. Borehole, UC 678, 79,0m., M.Ecca.
HOLOTYPE	Original designation; Tiw.'65, pl.9(200), p.206.
TYPE LOCALITY	India, Madhya Pradesh, Korba Coalfield 214. Borehole, R-69, ? depth, Barakar Fm.
NAME DERIVATION	L. simplex = simple; (? relevance).

DESCRIPTION (ref. pop.)

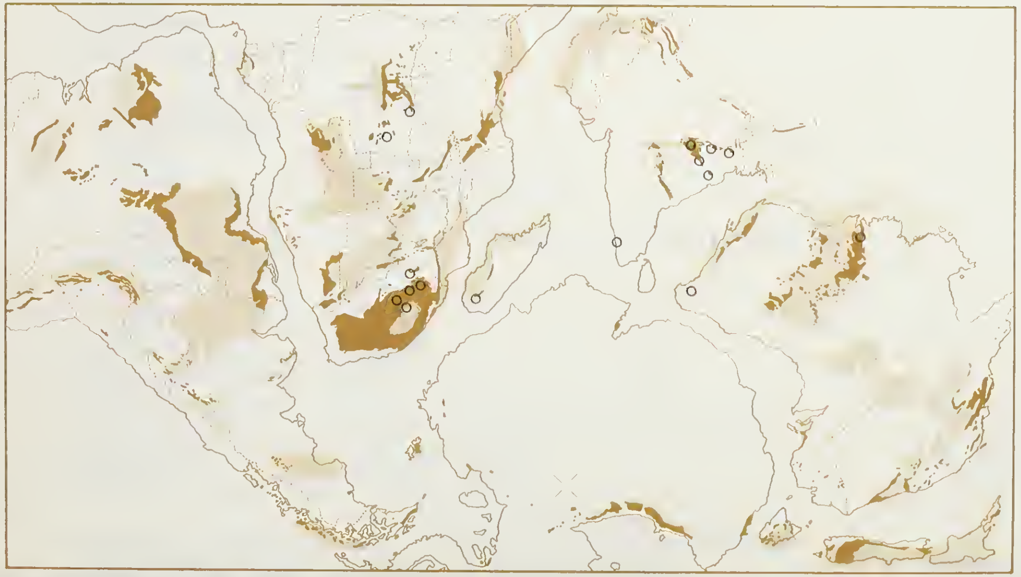
Overall grain	
Size	68(94)118.
Shape	Elongate oval.
Y-mark	Monolete.
Exoexine (Outer sheath)	
Cappa -dorsal	Fairly strongly intrareticulate; clearly defined longitudinal ribs (10 per 20mu).
-ventral	Cappa ribs encroach to occupy outer perimeter of ventral surface.
Cappula	All of ventral surface excluding part occupied by ventral ribs.
Sacci	Non-saccate.
Intexine (Inner body)	
Corpus -shape	as for genus.
-preserv.	?.

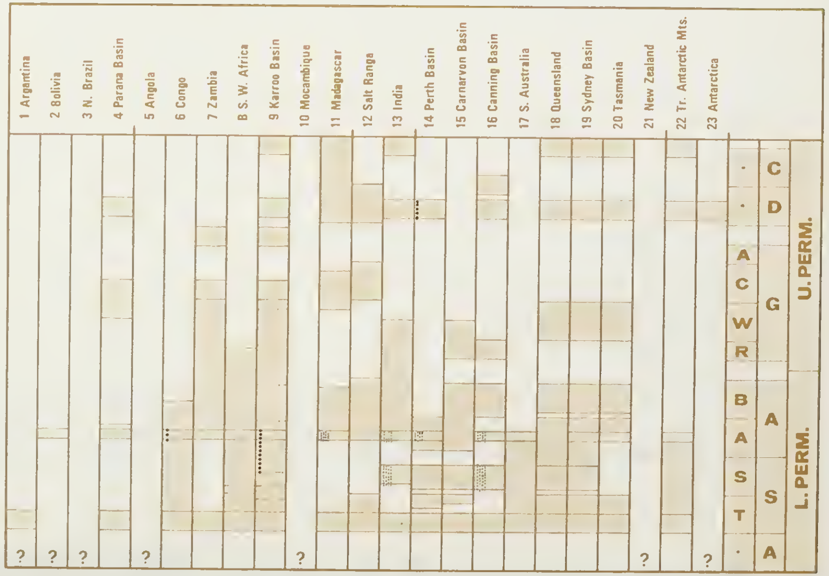
CLOSELY RELATED SPECIES

V.multistriata	OO; pl.128(1) - pl.121(30).
V.nonsaccata	OO; pl.128(1-13) - pl.127(1-7).

LITERATURE

6	Congo	Pier'59, pl.9(3); Hoeg & Bose'60, pl.35(4); Bose & Kar'66, pl.24(10), pl.34(7,8); Mahesh. & Kar'67, pl.1(5-7); Bose & Mahesh.'68, pl.21(6-8); Mahesh. & Bose'69, pl.4(16-18), pl.8(8,9).
9	Karroo Basin	This paper, pl.127, 128 in full.
11	Madagascar	Rakoto'70, pl.20(15).
13	India	Pot. & Sah.'60, pl.4(34); Tiw.'65, pl.8(193-195), pl.9(196,197,200,201,203,206-208); Maithy'65, pl.7(48-50); Maithy'66, pl.4(29); Nav.'66, pl.2(27); Mahesh. & Kar'67, pl.1(1-4); Nav. & Tiw.'67, pl.10(8,9); Tiw.'68, pl.8(88-90,92); Bharad. & Sriv.'69a, pl.29(105); Sriv.'70, pl.2(20-23); Saks.'71, pl.7(83).
	Australia	Balme'64, pl.3(9).
14	Perth Basin	Glick.'72, pl.40(11-13).
16	Canning Basin	Balme'73, pl.5(18,19), pl.6(7).





Vittatina lucifera (Bharad. & Sal.'64) comb. nov.

Decussatisporites lucifer Bharad. & Sal.'64

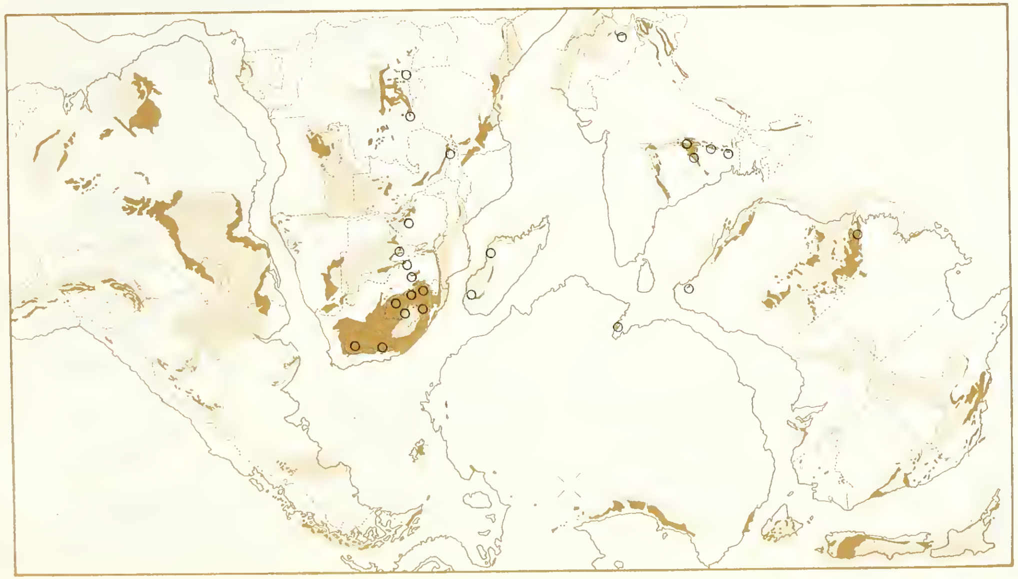
REFERENCE POPULATION	This paper, pl.129(1-93), 93 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, OW, 94', Tapinocephalus Zone equivalent.
HOLOTYPE	Original designation, Bharad. & Sal.'64, pl.12(169), p.213.
TYPE LOCALITY	India, Bihar, E.Raniganj Coalfield. ? Colliery, seam VIII, Raniganj Fm.
NAME DERIVATION	L. lux = the light; (transparent appearance when corpus lost).
DESCRIPTION (ref. pop.)	
Overall grain	
Size	20(44)54.
Shape	Oval.
Y-mark	Monolete.
Exoexine (Outer sheath)	
Cappa -dorsal	No intrareticulation; very clearly defined longitudinal ribs (11 per 20mu).
-ventral	Ribs occupy most of ventral surface.
Cappula	Narrow transverse.
Sacci	Non-saccate .
Intexine (Inner body)	
Corpus -shape	as for genus.
-preserv.	Frequently lost.

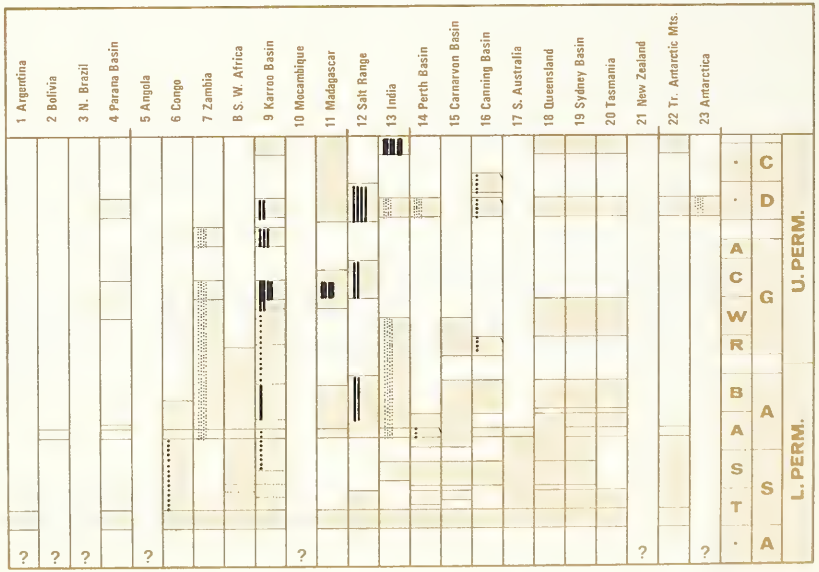
CLOSELY RELATED SPECIES

V.magma	OO; pl.129(62) - pl.131(24).
V.densa	OO; pl.129(10) - pl.132(1).

LITERATURE

6	Congo	Hoeg & Bose'60, pl.28(6,7); Kar & Bose'67, pl.11(8).
7	Zambia	Falc.'72, pl.11(15,22-26); (Utt.'70).
9	Karroo Basin	Hart'66a, pl.1(2-5); This paper, pl.129(1-93), pl.130(1-54); (Hart'66b).
11	Madagascar	Jek. & Goub.'64, pl.1(947); Goub.'65, pl.7(7,8), pl.8(1,2).
12	Salt Range	Balme'70, pl.21(19-22).
13	India	Bharad.'62, pl.5(93,94); Bharad. & Sal.'64, pl.12(169-171); Bharad. & Tiw.'64b, pl.2(23); Tiw.'65, pl.9(205); Kar'66, pl.2(38); Venk. & Kar'68a, pl.8(141-143); Kar'68a, pl.4(77,78,98-103); Bharad. & Sriv.69a, pl.28(91-104), pl.29(106,107,110-112); Sinha'72, pl.8(120).
14	Perth Basin	Glick.'72, pl.31(10-12).
16	Canning Basin	Balme'73, pl.1(2); (Balme'68).
23	Antarctica	(Kemp.'69).





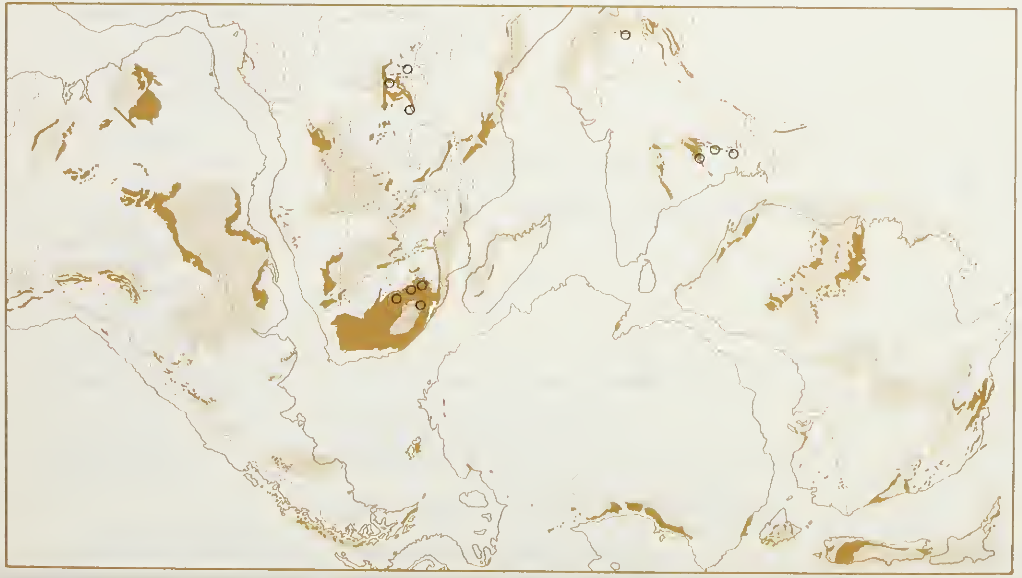
Vittatina magma (Bose & Kar'66) comb. nov.

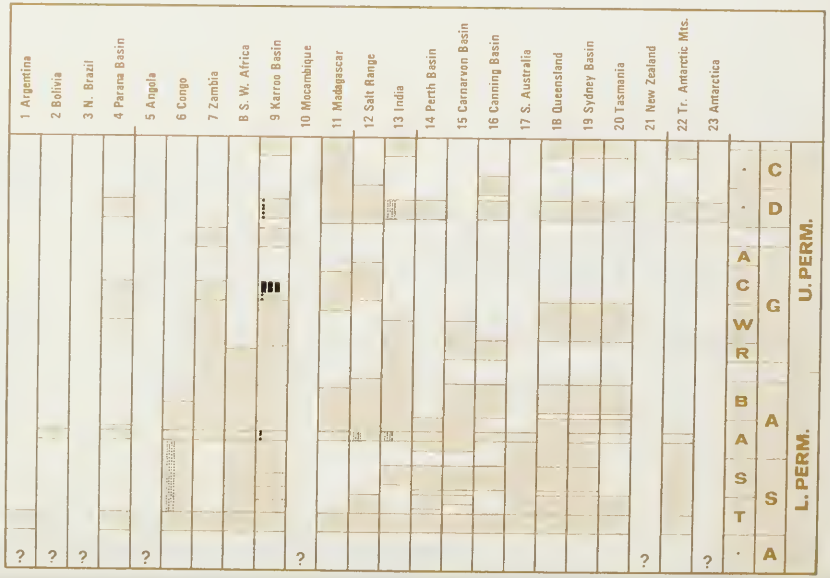
Decussatisporites magmus Bose & Kar'66

REFERENCE POPULATION	This paper, pl.131(1-43), 43 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, OW, 94', Tapinocephalus Zone equivalent.
HOLOTYPE	Original designation, Bose & Kar '66, pl.28(7), p.120.
TYPE LOCALITY	Congo, Walikale Region. Surface locality, Mehibi River, Assise des schistes noirs de Walikale.
NAME DERIVATION	L. magna = large; (relative overall size).
DESCRIPTION (ref. pop.)	
Overall grain	
Size	44(54)62.
Shape	Circular.
Y-mark	Monolete.
Exoexine (Outer sheath)	
Cappa -dorsal	No intrareticulation; very clearly defined longitudinal ribs (4 per 20mu).
-ventral	Ribs occupy most of ventral surface.
Cappula	Narrow transverse.
Sacci	Non-saccate.
Intexine (Inner body)	
Corpus -shape	as for genus.
-preserv.	Frequently lost.
CLOSELY RELATED SPECIES	
V.lucifera	OO; pl.131(24) - pl.129(62).

LITERATURE

6	Congo	Bose & Kar'66, pl.28(7,8), pl.34(14-16); Kar & Bose'67, pl.11(13).
9	Karroo Basin	Hart'66a, pl.1(6-8); This paper, pl.130(55-62), pl.131(1-43).
12	Salt Range	Venk. & Kar'68b, pl.6(70-72).
13	India	Sal.'65, pl.2(37); Venk. & Kar'68a, pl.10(188); Tiw.'68, pl.8(93-94).





Vittatina densa sp. nov.

REFERENCE POPULATION	This paper, pl.132(1-39), 39 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, OW, 94', Tapinocephalus Zone equivalent.
HOLOTYPE	This paper, pl.132(25).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION	L. densa = dense; (general appearance)

DESCRIPTION (ref. pop.)

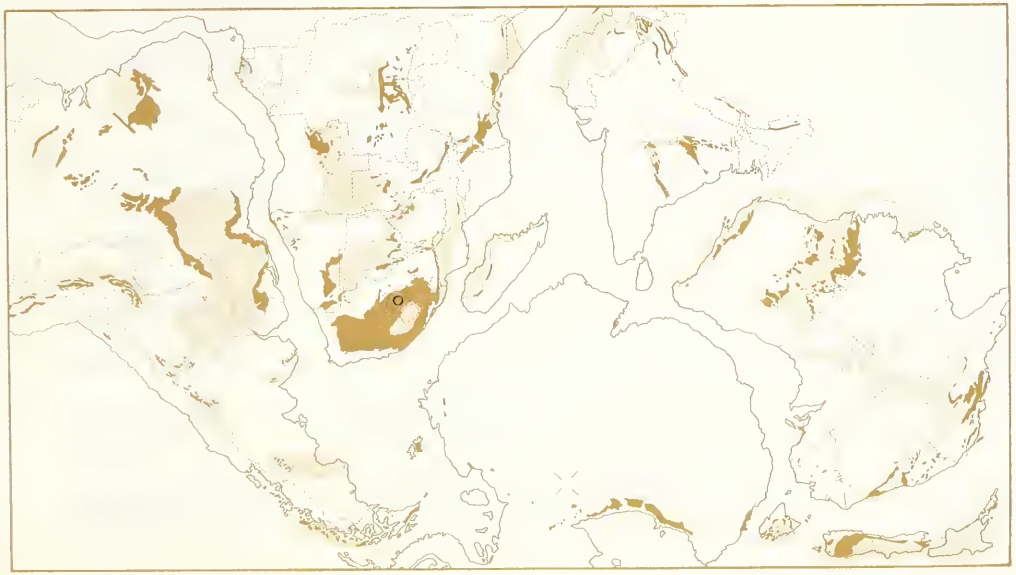
Overall grain	
Size	38 (44) 52.
Shape	Oval.
Y-mark	Monolete.
Exoexine (Outer sheath)	
Cappa -dorsal	Weakly intrareticulate; clearly defined longitudinal ribs (7 per 20mu).
-ventral	Ribs occupy most of ventral surface.
Cappula	Narrow transverse.
Sacci	Non-saccate.
Intexine (Inner body)	
Corpus -shape	as for genus.
-preserv.	Never lost.

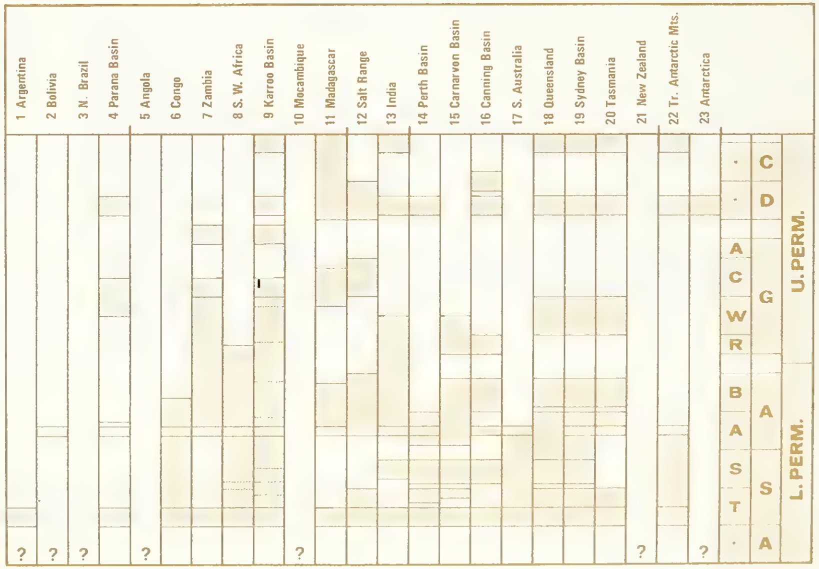
CLOSELY RELATED SPECIES

V.lucifera	OO; pl.132(1) - pl.129(10).

LITERATURE

9	Karroo Basin	This paper, pl.132(1-39).





Vittatina fasciolata (Balme & Henn.'56) comb. nov.

Marsupipollenites fasciolatus Balme & Henn.'56

REFERENCE POPULATION .	This paper, pl.133(1-34), 34 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1151'3" to 1152'9", L.Ecca equivalent.
HOLOTYPE	Not designated to date.
TYPE LOCALITY	W.Australia, Collie Basin. Co-operative Colliery, Main seam, ? Fm.
NAME DERIVATION . . .	L. fascis = bundle of sticks, straw etc.; (striated cappa).

DESCRIPTION (ref. pop.)

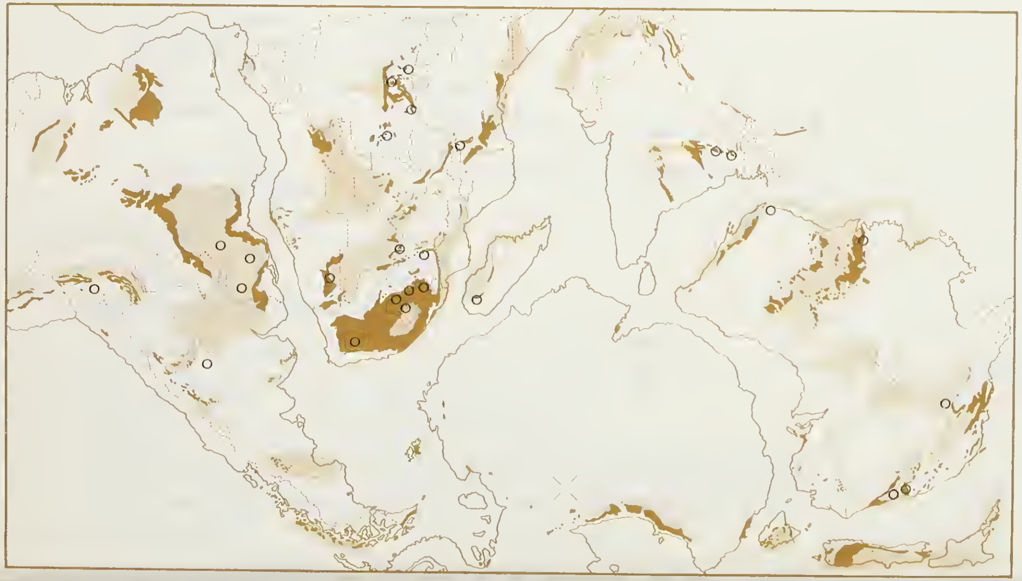
Overall grain	
Size	26 (36) 42.
Shape	Oval.
Y-mark	Monolete.
Exoexine (Outer sheath)	
Cappa -dorsal . . .	Very weakly intrareticulate; clearly defined longitudinal ribs (8 per 20 mu).
-ventral . . .	Levigate (no ribs), occupying most of ventral surface.
Cappula	Narrow transverse.
Sacci	Non-saccate.
Intexine (Inner body)	
Corpus -shape . . .	as for genus.
-preserv. . . .	Never lost.

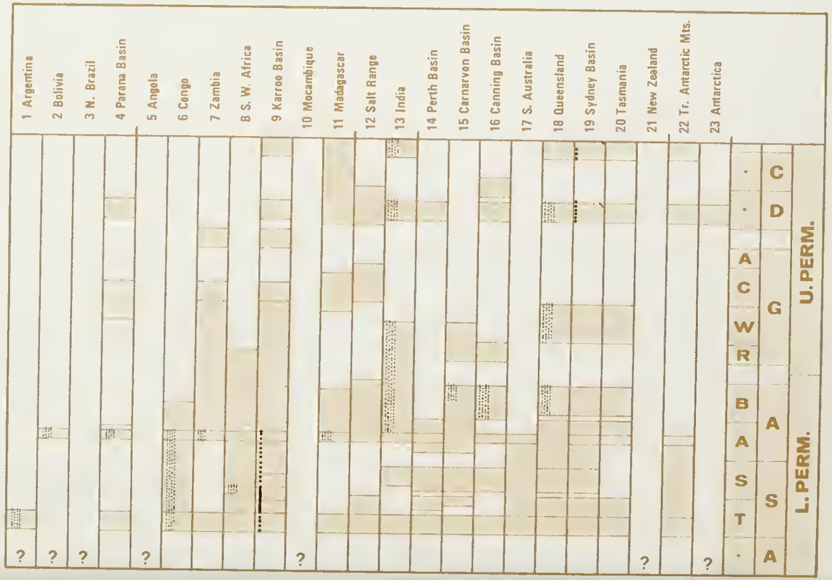
CLOSELY RELATED SPECIES

V.multistriata	◯◯; pl.133(46) - pl.123(5).

LITERATURE:

1	Argentina . .	Menend.'69, pl.2(6); Menend.'71, pl.6(7).
2	Bolivia . . .	Cousm.'65, pl.39(13-15).
4	Parana Basin .	Daem. & Quad.'70, pl.8(P-342,A-C).
6	Congo . . .	Pier.'59, pl.7(2); Bose & Kar'66, pl.15(5,6), pl.17(4-6), pl.27(15), pl.28(8-14,16-18), pl.29(1-11,14,16-18), pl.34(5,6,12,13); Kar & Bose'67, pl.11(2,3,5-7,9-11,20); Bose & Mahesh.'68, pl.22(11); Mahesh. & Bose'69, pl.8(10-12).
7	Zambia . .	Hart'60, pl.3(44).
8	S.W.Africa . .	Lesch.'59, pl.5(32,33).
9	Karroo Basin .	This paper, pl.133(1-47); (Hart'66b).
11	Madagascar . .	Rakoto.'70, pl.23(6-9).
13	India	Bharad. & Sal.'64, pl.12(166,167); Kar'68a, pl.4(96,97); Kar.'68c, pl.1(22); Bharad. & Sriv.'69a, pl.29(108,109,113,114,116).
	Australia . . .	Balme & Henn.'56a, pl.3(42-45).
15	Carnarvon Basin .	(Balme'67).
16	Canning Basin .	Balme'73, pl.3(13).
18	Queensland . .	(Rig.'73).
19	Sydney Basin .	Helby'70, pl.37(17); (Balme & Henn.'56a; Evans'67b).





Vittatina triradiata (Balme & Henn.'56) comb. nov.

Marsupipollenites triradiatus Balme & Henn.'56

REFERENCE POPULATION	This paper, pl.134(1-66), 64 specimens.
REFERENCE LOCALITY	S.Africa, central Transvaal, Springbok Flats. Surface locality, HKr., M.Ecca.
HOLOTYPE	Not designated to date.
TYPE LOCALITY	N.S.W. Sydney Basin. Borehole, S.Wallarah No.5, seam at 688', Newcastle C.M.
NAME DERIVATION	L. tres = three; L. radiatas = radial; (Y-mark).
DESCRIPTION (ref. pop.)	
Overall grain	
Size	30(40)48.
Shape	Circular.
Y-mark	Trilete.
Exoexine (Outer sheath)	
Cappa -dorsal	Strongly intrareticulate; partially defined longitudinal ribs (9 per 20mu)
-ventral	Strongly intrareticulate (no ribs), occupying most of ventral surface.
Cappula	Narrow transverse.
Sacci	Non-saccate.
Intexine (Inner body)	
Corpus -shape	as for genus.
-preserv.	Frequently lost.

CLOSELY RELATED SPECIES

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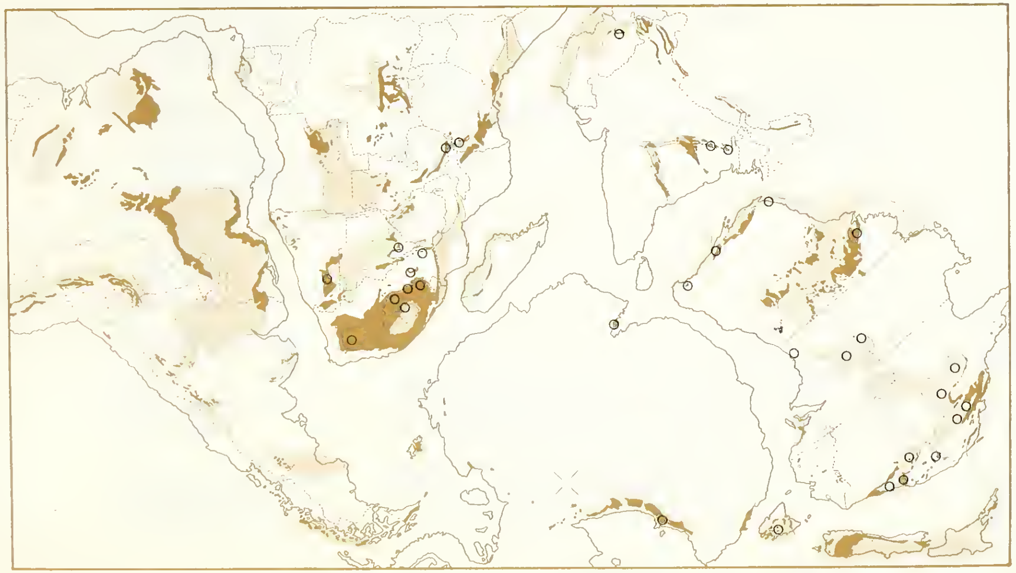
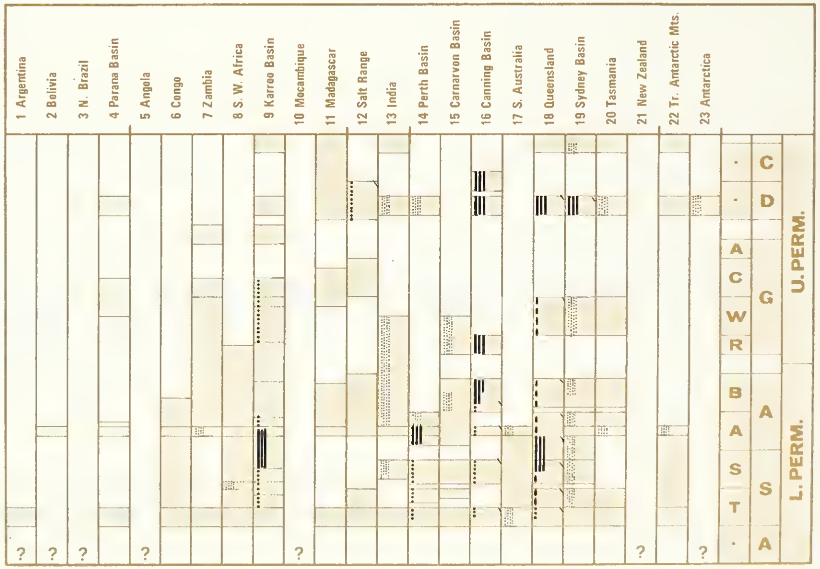
LITERATURE

4	Parana Basin	Daem. & Quad.'70, pl.5(P-461,B).
7	Zambia	Hart'60, pl.3(40); Hart'63, pl.1(6); (Utt.'70).
8	S.W.Africa	Lesch.'59, pl.1(4,6), pl.5(37,39-41).
9	Karroo Basin	This paper, pl.134,135 in full; (Hart'66b).
12	Salt Range	Balme'70, pl.21(15-18).
13	India	Maithy'65, pl.7(52); Kar'66, pl.2(37,39); Kar'68a, pl.4(82-86); Kar'69b, pl.1(5).
	Australia	Balme & Henn.'56a, pl.1(29-37); Balme'64, pl.4(1-3);
14	Perth Basin	Segr.'70, pl.11(H,I); Segr.'72, pl.4(6); Glick.'72, pl.42(4-11).
15	Carnarvon Basin	(Balme'67).
16	Canning Basin	Balme'73, pl.1(1), pl.3(9,10), pl.4(17), pl.6(1); (Balme'68).
17	S.Australia	(Evans'64b; Har. & Lud.'66; Har. & McG.'67).
18	Queensland	Hill & Woods ±'63, pl.15(9); (Evans'64a,c,'66a,b,c,'67a; Pat.'65; deJers.'70; Rig.'73).
19	Sydney Basin	Helby'70, pl.37(1-11); (Balme & Henn.'56a; Evans'67b; McK. & Gut.'69).
20	Tasmania	(Balme & Henn.'56a; Banks & Naqvi'67).
22	Tr.Antarctic Mts.	(Kyle'73 letter).
23	Antarctica	(Kemp'69).





Pityosporites nectus (Venk. & Kar'68) comb. nov.

Labiisporites nectus Venk. & Kar'68

REFERENCE POPULATION .	Bharad & Sriv.'69a, pl.27(50-59), 10 specimens.
REFERENCE LOCALITY .	India, Madhya Pradesh, Sidhi district. Surface locality, near Nidpur village, ? Fm.
HOLOTYPE	Original designation, Venk. & Kar '68b, pl.4(42), p.163.
TYPE LOCALITY	West Pakistan, Salt Range. Surface locality, shale 25' above Boulder Bed, Kathwai Shales.
NAME DERIVATION . . .	(? derivation).

DESCRIPTION (ref. pop.)

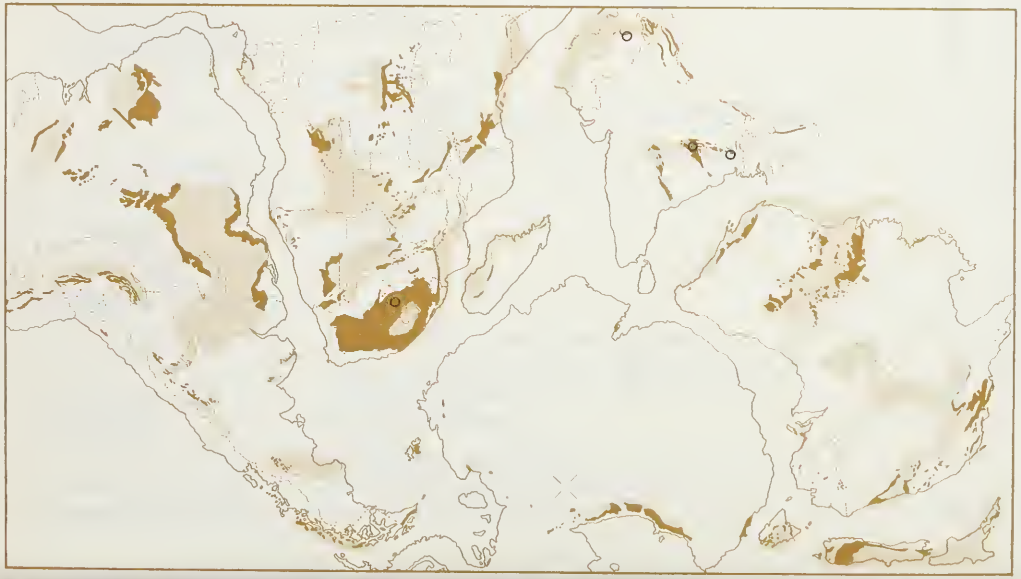
Overall grain	
Size	100(120)136.
Shape	Elongate oval.
Y-mark	—
Exoexine (Outer sheath)	
Cappa -dorsal . . .	Non-striate.
-ventral . . .	as for genus
Cappula	Sacci meet laterally and ventrally leaving simply a linear joint.
Sacci	Disaccate; slightly diploxylonoid; 1 x corpus; slight distal inclination.
Intexine (Inner body)	
Corpus -shape . . .	See notes for genus.
-preserv. . . .	Development of strong transverse terminal folds.

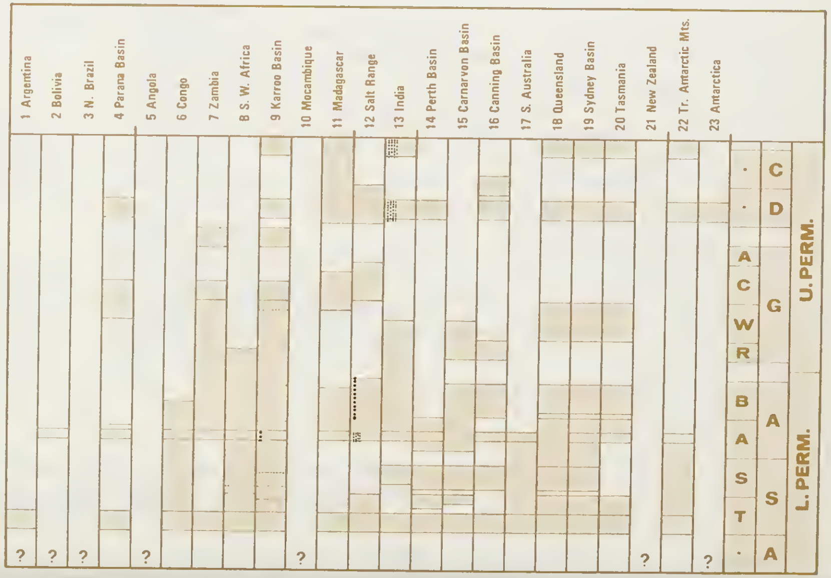
CLOSELY RELATED SPECIES

P.triassicus	OO; pl.136(3) - pl.136(14).

LITERATURE

9	Karroo Basin .	This paper, pl.136(1-9).
12	Salt Range . .	Venk. & Kar'68b, pl.4(42,43); Balme'70, pl.19(1-3).
13	India	Bharad.'62, pl.19(252,253), pl.20(262-264); Bharad. & Sriv.'69a, pl.27(50-59).





Pityosporites triassicus (Bharad. & Sriv.'69) comb. nov.

Satsangisaccites triassicus Bharad. & Sriv.'69

REFERENCE POPULATION .	This paper, pl.137(1-19), 19 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, OW, 94', Tapinocephalus Zone equivalent.
HOLOTYPE	Original designation, Bharad & Sriv.'69a, pl.27(61), p.132.
TYPE LOCALITY	India, Madhya Pradesh, Sidhi district. Surface locality, near Nidpur village, ? Fm.
NAME DERIVATION . . .	After Triassic System.

DESCRIPTION (ref. pop.)

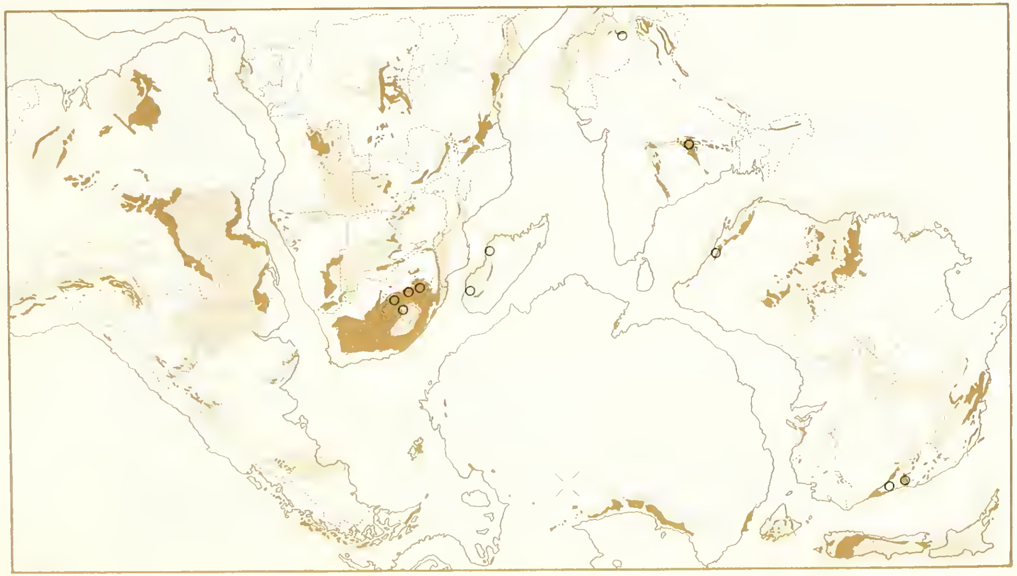
Overall grain	
Size	48(68)80.
Shape	Elongate oval.
Y-mark	—
Exoexine (Outer sheath)	
Cappa -dorsal . . .	Non-striate.
-ventral . . .	as for genus.
Cappula	Sacci meet laterally and ventrally leaving simply a linear joint.
Sacci	Disaccate; slightly diploxylonoid; 1 x corpus; slight distal inclination.
Intexine (Inner body)	
Corpus -shape . . .	See notes for genus.
-preserv. . . .	Development of strong transverse terminal folds.

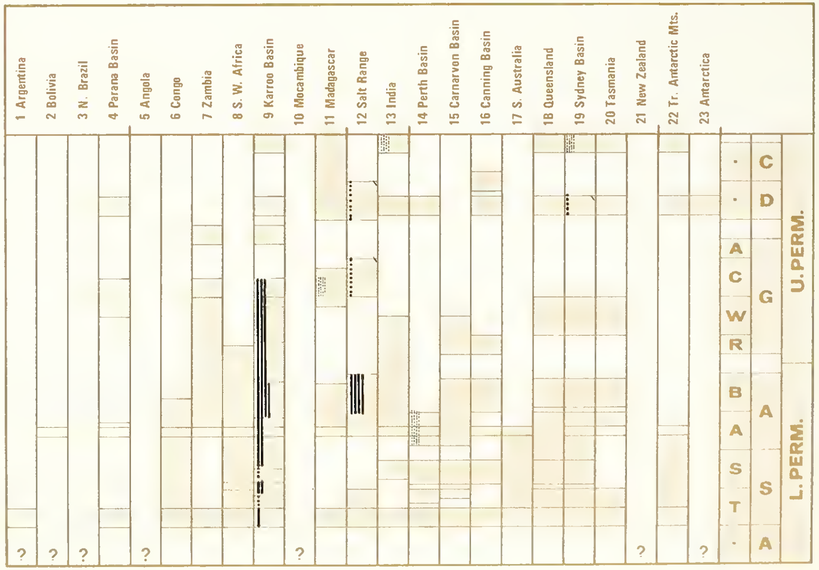
CLOSELY RELATED SPECIES

P.nectus	OO; pl.136(14) - pl.136(3).
P.nucleoparvus	0 ; pl.137(in full) - pl.138(in full).
P.ovatus	00 ; pl.137(2) - pl.144(25).

LITERATURE

7	Zambia . . .	Falc.'72, pl.15(1,4,10).
9	Karroo Basin .	This paper, pl.136(1--19), pl.137(1-19).
11	Madagascar . .	Jek. & Goub.'64, fig.5(1067); Goub.'65, pl.4(6).
12	Salt Range . .	Balme'70, pl.15(15-18).
13	India	Bharad. & Sriv.'69a, pl.27(61-68), pl.28(73-86).
14	Perth Basin . .	Segr.'69, pl.1(E,F), pl.6(G); Segr.'72, pl.4(8).
19	Sydney Basin .	(Helby'70).



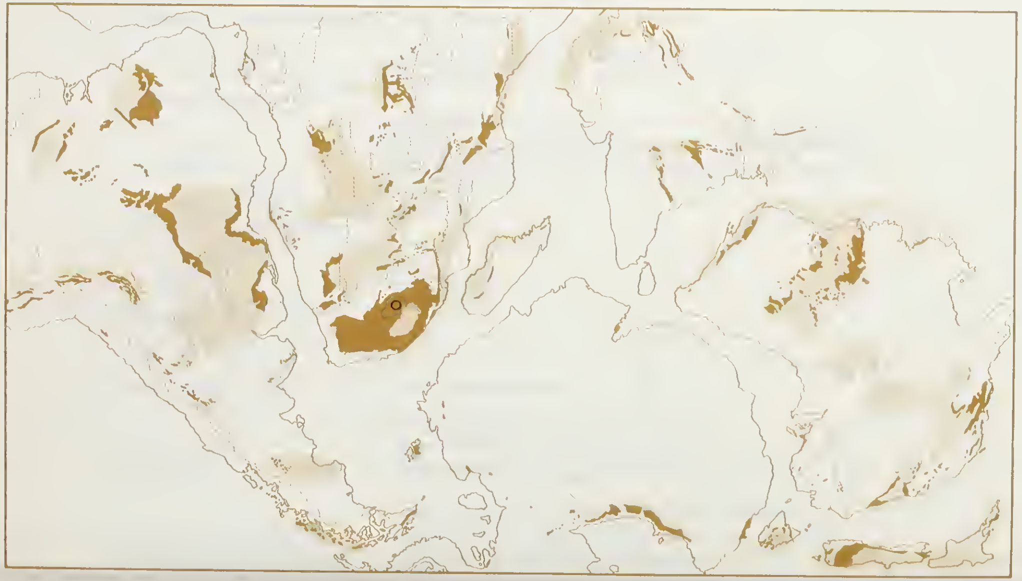


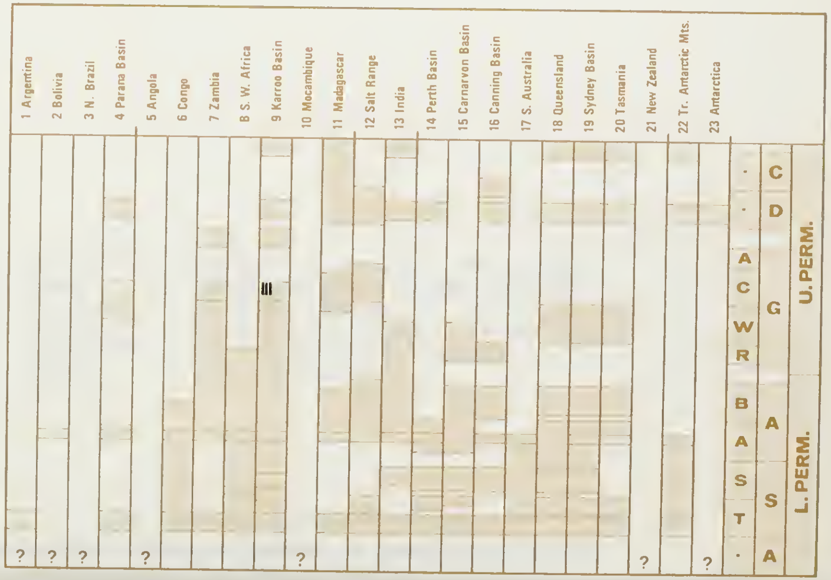
Pityosporites nucleoparvus sp. nov.

REFERENCE POPULATION .	This paper, pl.138(1-52), 53 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, OW, 94', Tapinocephalus Zone equivalent.
HOLOTYPE	This paper, pl.138(24)
TYPE LOCALITY	As for reference locality.
NAME DERIVATION . . .	L. nucleus = nucleus; L. parvus = small; (small corpus).
DESCRIPTION (ref. pop.)	
Overall grain	
Size	50(60)84.
Shape	Elongate oval.
Y-mark	—
Exoexine (Outer sheath)	
Cappa -dorsal . . .	Non-striate.
-ventral . . .	as for genus.
Cappula	Sacci meet laterally and ventrally leaving simply a linear joint.
Sacci	Disaccate; diploxylonoid; 1½ x corpus; slight distal inclination.
Intexine (Inner body)	
Corpus -shape . . .	See notes for genus.
-preserv. . . .	Development of strong transverse terminal folds.
CLOSELY RELATED SPECIES	
P.triassicus	① ; pl.138(in full) - pl.137(in full).

LITERATURE

9	Karroo Basin .	This paper, pl.138(1-52).





REFERENCE POPULATION	This paper, pl.139(1-15), 15 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Oliviershoek Pass area. Surface locality, Kb, L.Beaufort (Daptocephalus Zone).
HOLOTYPE	Original designation, Segr.'69, pl.6(A,B), p.192.
TYPE LOCALITY	W.Australia, northern Perth Basin, Indarra District. Borehole, 47¼ Mile Bore, 1410 - 1415', 'Artinskian'.
NAME DERIVATION	After Indarra District.
DESCRIPTION (ref. pop.)	
Overall grain	
Size	24(32) 40.
Shape	Elongate oval.
Y-mark	—
Exoexine (Outer sheath)	
Cappa -dorsal	Non-striate.
-ventral	as for genus.
Cappula	Sacci meet laterally and ventrally leaving simply a linear joint.
Sacci	Disaccate; slightly diploxylonoid; 1 x corpus; slight distal inclination.
Intexine (Inner body)	
Corpus -shape	See notes for genus.
-preserv.	Development of strong transverse terminal folds.

CLOSELY RELATED SPECIES

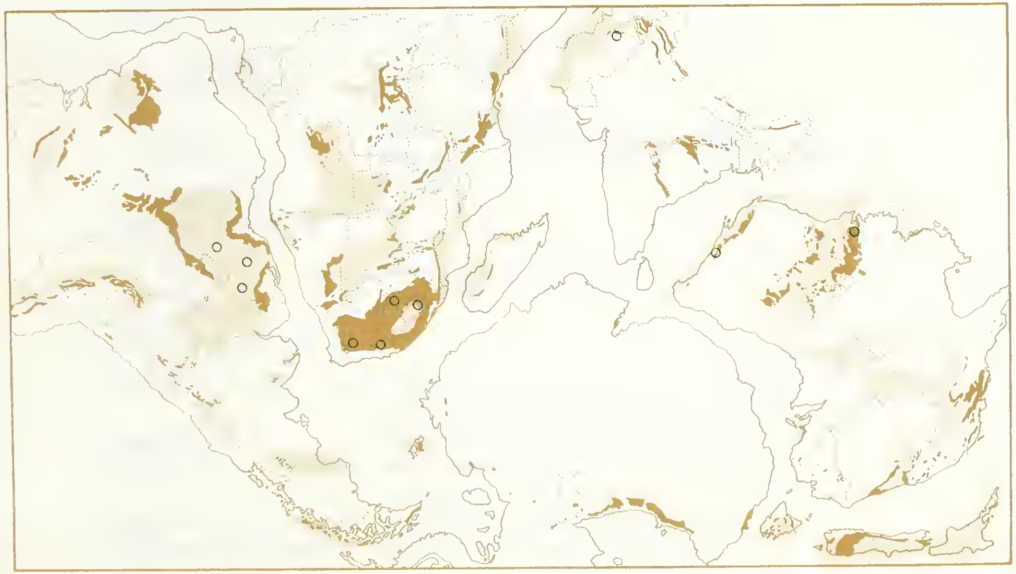
P.tenuicorpus	OO; pl.139(15) - pl.139(16).

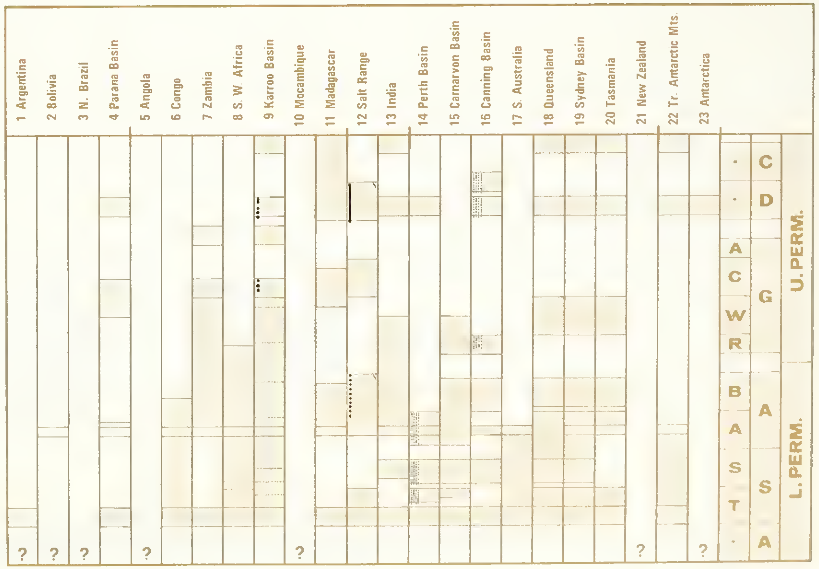
Pityosporites indarraensis (Segr.'69) comb. nov.

Alisporites indarraensis Segr.'69

LITERATURE

4	Parana Basin	Daem. & Quad.70, pl.8(P-331,A).
9	Karroo Basin	This paper, pl.139(1-15).
12	Salt Range	Balme'70, pl.15(5,6).
14	Perth Basin	Segr.'69, pl.6(A-C); Segr.'72, pl.3(5).
16	Canning Basin	Balme'73, pl.1(3).





Pityosporites tenuicorpus (Balme'70) comb. nov.

Alisporites tenuicorpus Balme '70

REFERENCE POPULATION .	This paper, pl.141(1-78), 100 + specimens.
REFERENCE LOCALITY .	S.Africa, central Transvaal, Springbok Flats. Surface locality, HKr., M.Ecca.
HOLOTYPE	Original designation, Balme '70, pl.15(3), p.394.
TYPE LOCALITY	West Pakistan, Salt Range. Surface locality, Wargal, Field no.K11-6c, Chhidru Fm.
NAME DERIVATION . . .	L. tenuis = fine, thin; L. corpus = body; (delicate corpus).

DESCRIPTION (ref. pop.)

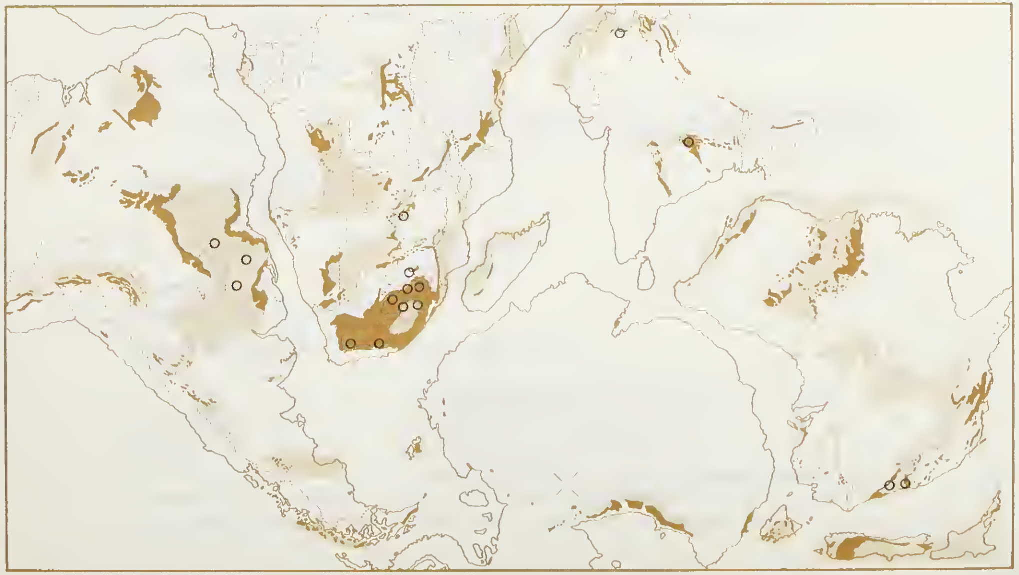
Overall grain	
Size	26(36)46.
Shape	Elongate oval (oval) broadly oval.
Y-mark	—
Exoexine (Outer sheath)	
Cappa -dorsal . . .	Non-striate.
-ventral . . .	as for genus.
Cappula	Sacci meet laterally and ventrally leaving simply a linear joint.
Sacci	Disaccate; slightly diploxylonoid; ¾ x corpus; medium distal inclination.
Intexine (Inner body)	
Corpus -shape . . .	See notes for genus.
-preserv. . .	Development of strong transverse terminal folds.

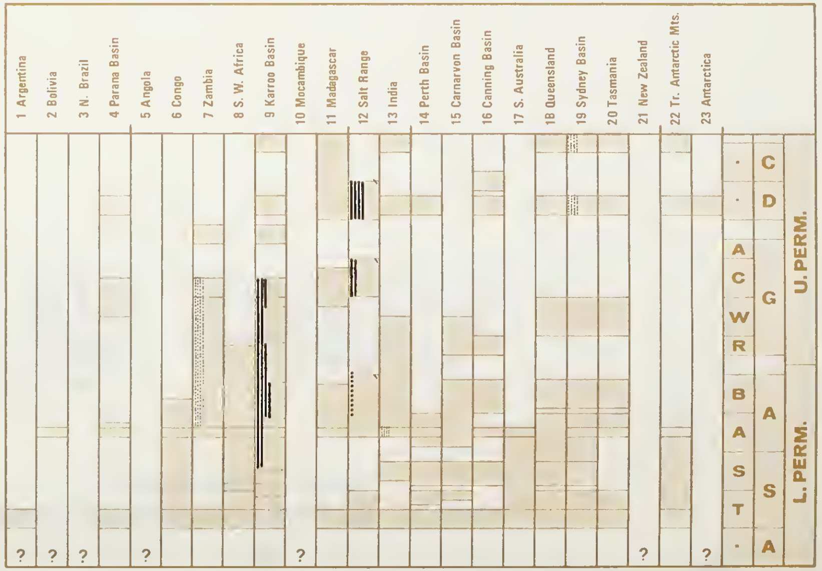
CLOSELY RELATED SPECIES

P.indarraensis	OO; pl.139(16) - pl.139(15).
P.ovatus	⦶ ; pl.141(6) - pl.145(1).

LITERATURE

4	Parana Basin . .	Daem. & Quad.'70, pl.8(P-331,C).
7	Zambia . . .	Falc.'72, pl.15(14).
9	Karroo Basin .	This paper, pl.139(16-24), pl.140,141 in full.
12	Salt Range . .	Balme'70, pl.15(1-4).
13	India	Sinha'72, pl.8(114).
19	Sydney Basin .	(Helby '70),





Pityosporites ovatus (Balme & Henn.'55) comb. nov.

Florinites ovatus Balme & Henn.'55

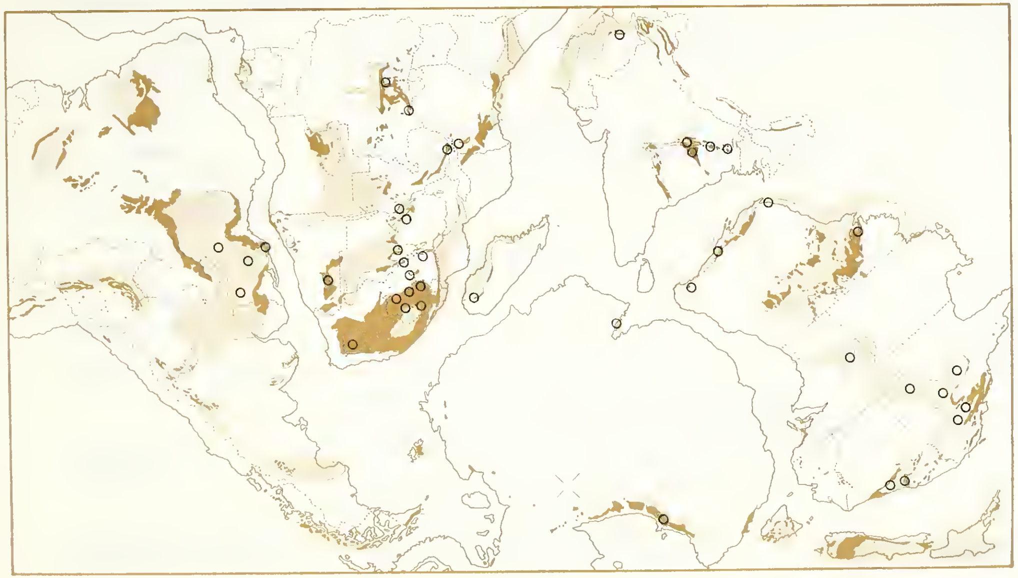
REFERENCE POPULATION	This paper, pl.142-147 in full, ±283 specimens.
REFERENCE LOCALITY	S.Africa, central Transvaal, Springbok Flats. Surface locality, HKr., M.Ecca.
HOLOTYPE	Not designated to date.
TYPE LOCALITY	W.Australia, Collie Basin (N.E.Basin). Borehole, No.6, seam at 174', ? Fm.
NAME DERIVATION	L. ovatus = ovate; (overall shape).
DESCRIPTION (ref. pop.)	
Overall grain	
Size	32(53)74.
Shape	Elongate oval (oval) broadly oval to circular
Y-mark	—
Exoexine (Outer sheath)	
Cappa -dorsal	Non-striate.
-ventral	as for genus.
Cappula	Sacci meet laterally and ventrally leaving simply a linear joint.
Sacci	Disaccate; haploxylonoid; ¾ x corpus; slight distal inclination.
Intexine (Inner body)	
Corpus -shape	See notes for genus.
-preserv.	Development of strong transverse terminal folds.

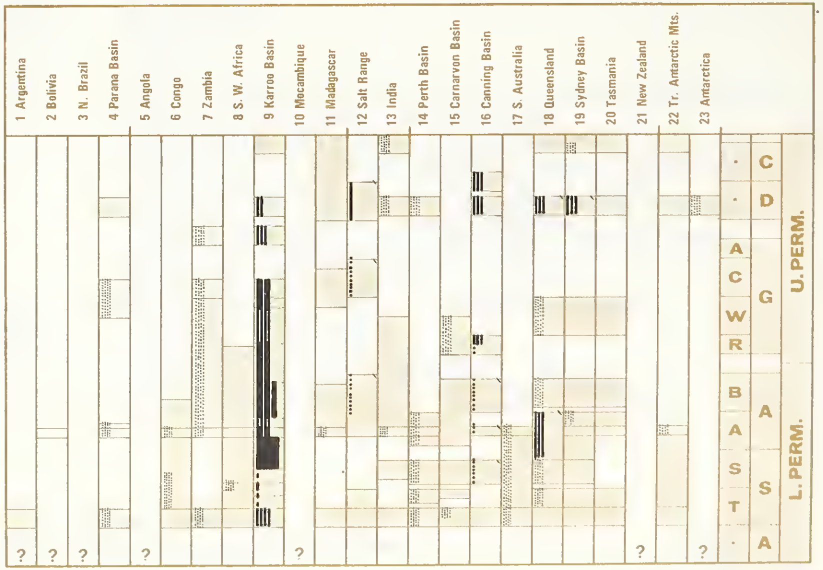
CLOSELY RELATED SPECIES

P.triassicus	ꝏ	pl.144(25) - pl.137(2).
P.tenuicorpus	ꝏ	pl.145(1) - pl.141(6).
P.maximus	OO	pl.142(32) - pl.149(1).
P.goraiensis	ꝏ	pl.142(43) - pl.154(16).

LITERATURE:

4	Parana Basin	Tiw. & Nav.'67, pl.1(16 17); Daem. & Quad.'70, pl.8(P-331,B).
6	Congo	Kar & Bose'66, pl.33(1); Mahesh. & Bose'69, pl.5(10,11).
7	Zambia	Hart'60, pl.3(41,42); Falc.'72, pl.15(6-9,11); (Utt.'70).
8	S.W.Africa	Lesch.'59, pl.1(17).
9	Karroo Basin	This paper, pl.142-147 in full; (Hart'66b).
11	Madagascar	Rakoto.'70, pl.18(3-6,12).
12	Salt Range	Balme'70, pl.15(7-9).
13	India	Bharad.'62, pl.19(249-251), pl.20(259); Bharad. & Sal.'64, pl.12(162); Tiw.'65, pl.7(156), pl.8(171-175,179-182); Venk. & Kar'68a, pl.9(169,171); Tiw.'68, pl.7(82,83); Bharad. & Sriv.'69a, pl.28(71,72). Saks.'71, pl.6(67,68); Sinha'72, pl.8(112,113).
	Australia	Balme & Henn.'55, pl.5(49-52); Balme'64, pl.3(12).
14	Perth Basin	Segr.'69, pl.7(D,E); Glick.'72, pl.31(4-6).
15	Carnarvon Basin	(Balme'67).
16	Canning Basin	Balme'73, pl.1(4,5), pl. 3(14), pl.4(11,12), pl.6(4); (Balme'68).
17	S.Australia	(Har. & McG.'67).
18	Queensland	deJers.'70, pl.5(1); (Evans'64a,c,'66a,b,c,'67a; Norv.'71; Rig.'73).
19	Sydney Basin	Henn.'58, pl.5(15); Helby'70, pl.38(1,3-5); (Balme & Henn.'55; Evans'67b).
22	Tr.Antarctic Mts.	(Kyle'73 letter).
23	Antarctica	Balme & Playf.'67, pl.1(16).





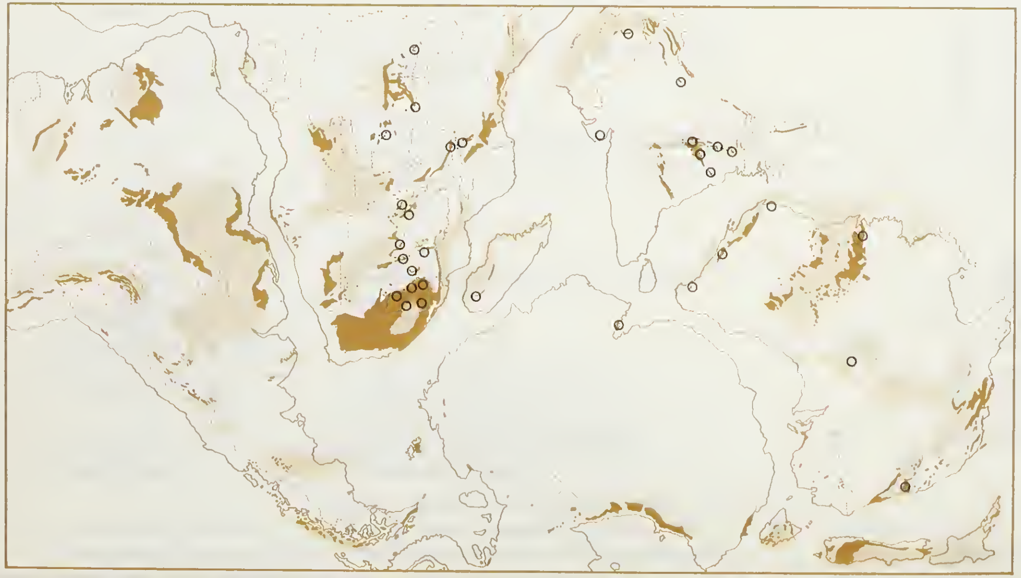
Pityosporites maximus (Hart'60) comb. nov.

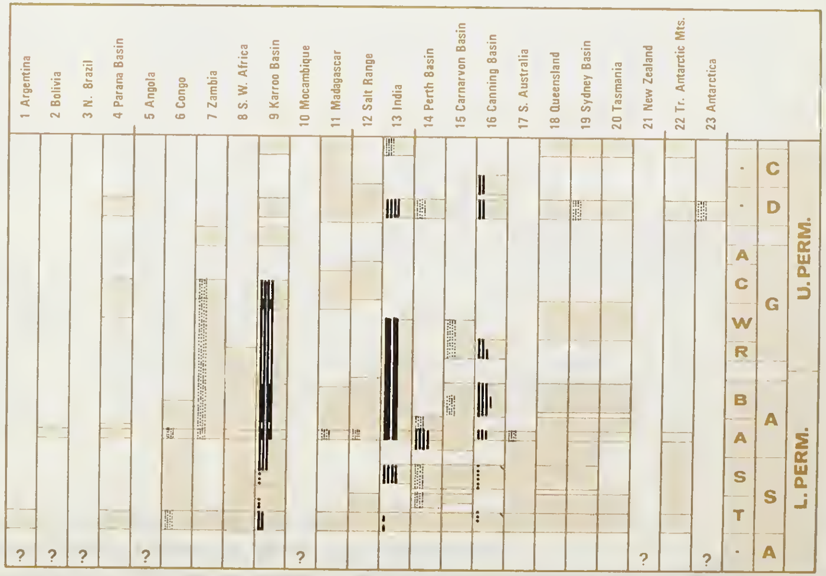
Vesicaspora maxima Hart'60

REFERENCE POPULATION	This paper, pl.148-150 in full, 58 specimens.
REFERENCE LOCALITY	S.Africa, central Transvaal, Springbok Flats. Surface locality, HKr., M.Ecca.
HOLOTYPE	Original designation, Hart '60, pl.3(33), p.10.
TYPE LOCALITY	Tanzania, Ruhuhu Valley, Ketewaka-Mchuchuma Coalfield. Surface locality, Mchuchuma River valley, coal 8' above C.S. 12 of McKinlay, K2 Coal Measures.
NAME DERIVATION	L. maximus = largest; (relative overall size).
DESCRIPTION (ref. pop.)	
Overall grain	
Size	68(94)120.
Shape	Oval (broadly oval) circular.
Y-mark	—
Exoexine (Outer sheath)	
Cappa -dorsal	Non-striate.
-ventral	as for genus.
Cappula	Sacci meet laterally and ventrally leaving simply a linear joint.
Sacci	Disaccate; haploxylonoid; ¾ x corpus; slight distal inclination.
Intexine (Inner body)	
Corpus -shape	See notes for genus.
-preserv.	Development of transverse terminal and medial folds.
CLOSELY RELATED SPECIES	
P.ovatus	OO; pl.149(1) - pl.142(32).
P.levis	ꝏ; pl.150(8) - pl.151(22).
P.goraiensis	ꝏ; pl.148(6) - pl.154(41).

LITERATURE

6	Congo	Hoeg & Bose'60, pl.33(4), pl.34(1-5); Bose & Mahesh.'66, pl.6(1); Bose & Mahesh.'68, pl.22(2); Mahesh. & Bose'69, pl.7(3,6).
7	Zambia	Hart'60, pl.3(33,34); Falc.'72, pl.15(16,18); (Utt.'70).
9	Karroo Basin	This paper, pl.148-150 in full; (Hart'66b).
11	Madagascar	Rakoto.'70, pl.18(7-9,11,13,14).
12	Salt Range	Lak., Sah & Dube'60, pl.7(18,19); Venk. & Kar'68b, pl.4(48).
13	India	Bharad.'62, pl.20(254-256,258); Bharad. & Sal.'64, pl.12(161); Tiw.'65, pl.8(176-178); Bharad. et al.'65, pl.3(25,26); Maithy'66, pl.3(23); Nav.'66, pl.3(36); Bharad. & Tiw.'66, pl.2(15,16); Nav. & Tiw.'66, pl.2(21); Bharad.'66, pl.3(37); Mahesh.'67, pl.8(68); Nav. & Tiw.'68, pl.1(9,15); Venk. & Kar'68a, pl.9(170,174); Tiw.'68, pl.5(63), pl.7(75-81); Bharad. & Sriv.'69a, pl.28(69,70); Maithy'69, pl.3(14); Venk.'70, pl.1(6); Sinha'72, pl.8(115,116,118,119); Anand.'72, pl.1 in full.
	Australia	Balme & Henn.'55, pl.5(46,47); Balme'64, pl.4(17).
14	Perth Basin	Balme'52, fig.49(P40B); Segr.'69, pl.7(A-C,F); Segr.'72, pl.3(2), pl.4(11); Glick.'72, pl.33(1-6), pl.34(1,2).
15	Carnarvon Basin	(Balme'67).
16	Canning Basin	Balme'73, pl.4(19,20); (Balme'68).
17	S.Australia	(Har. & McG.'67).
19	Sydney Basin	Helby'70, pl.39(7,8).
23	Antarctica	Balme & Playf.'67, pl.2(6).





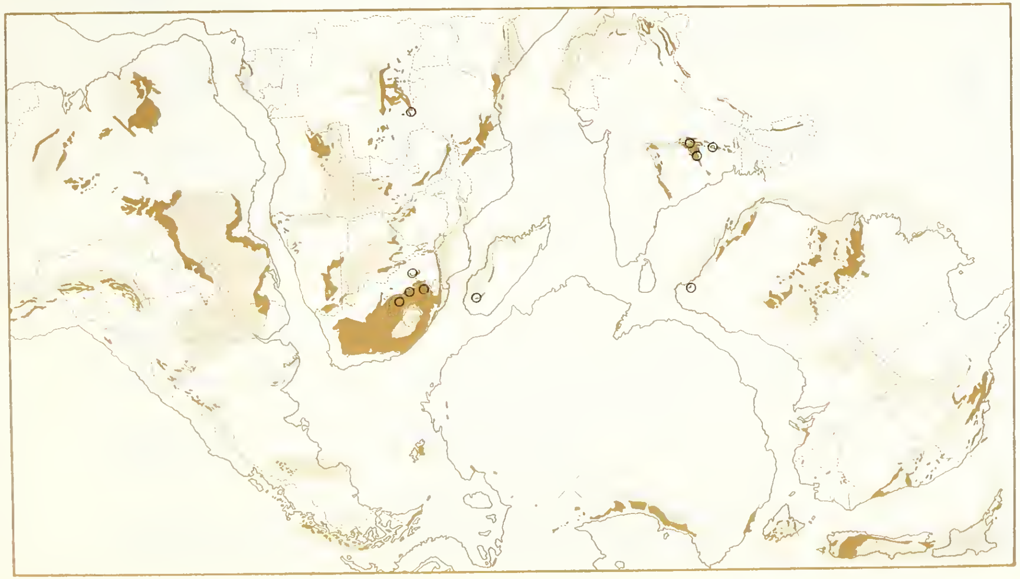
Pityosporites levis (Tiw.'64) comb. nov.

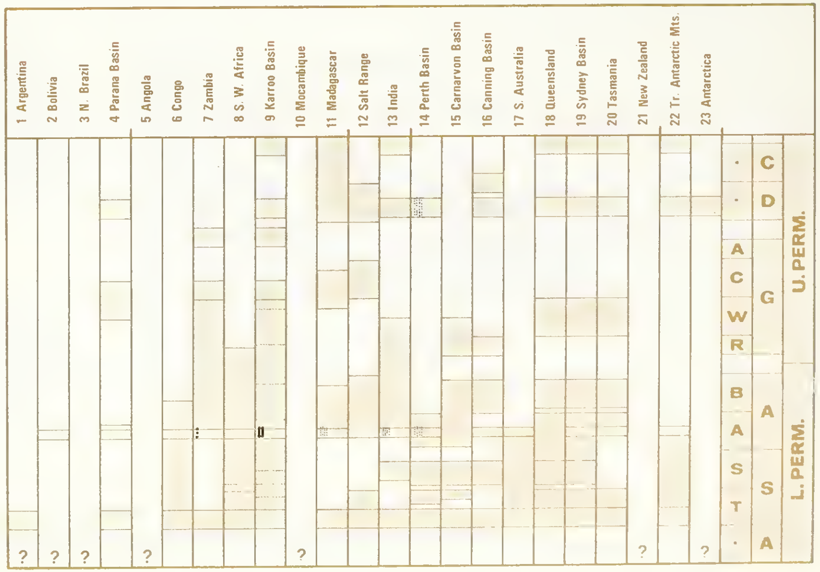
Primuspollenites levis Tiw.'64

REFERENCE POPULATION	This paper, pl.151-152 in full, 46 specimens.
REFERENCE LOCALITY	S.Africa, central Transvaal, Springbok Flats. Surface locality, HKr., M.Ecca.
HOLOTYPE	Original designation, Tiw.'64, pl.1(9), p.255.
TYPE LOCALITY	India, Madhya Pradesh, Korba Coalfield. Borehole, R-34, 202 (2 seam) E, Barakar Fm.
NAME DERIVATION	L. levis = light (weight); (? significance).
DESCRIPTION (ref. pop.)	
Overall grain	
Size	72(82)92.
Shape	Elongate oval.
Y-mark	—
Exoexine (Outer sheath)	
Cappa -dorsal	Non-striate.
-ventral	as for genus.
Cappula	Sacci meet laterally and ventrally leaving simply a linear joint.
Sacci	Disaccate; diploxylonoid; 1½ x corpus; slight distal inclination.
Intexine (Inner body)	
Corpus -shape	See notes for genus.
-preserv.	Development of strong transverse medial folds.
CLOSELY RELATED SPECIES	
P.maximus	ꝏ; pl.151(22) - pl.150(8).
P.fusus	ꝏ; pl.152(7) - pl.153(3).

LITERATURE

6	Congo	Hoeg & Bose'60, pl.35(5).
9	Karroo Basin	This paper, pl.151, 152 in full.
11	Madagascar	Rakoto.'70, pl.21(6).
13	India	Virk.'46, pl.13(176); Tiw.'64, pl.1(9,10); Bharad. & Tiw.'64b, pl.1(16), pl.2(19,20); Tiw.'65, pl.5(97,98,108), pl.6(113-116).
14	Perth Basin	Glick.'72, pl.35(4).





Pityosporites fusus (Balme & Henn.'55) comb. nov.

Lueckisporites fusus Balme & Henn.'55

REFERENCE POPULATION .	This paper, pl.153(1-18), 18 specimens.
REFERENCE LOCALITY .	S.Africa, central Transvaal, Springbok Flats. Surface locality, HKr., M.Ecca.
HOLOTYPE	Not designated to date.
TYPE LOCALITY	W.Australia, Collie Basin. ? Colliery, Cardiff Seam, Cardiff Fm.
NAME DERIVATION . . .	L. fusus = spread, extend; (saccate condition).

DESCRIPTION (ref. pop.)

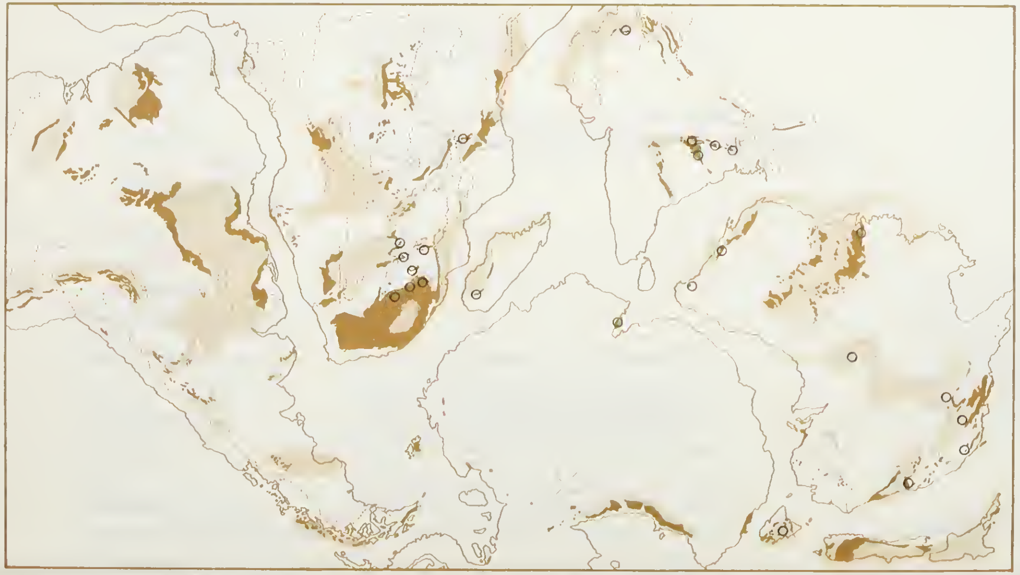
Overall grain	
Size	82(97)112.
Shape	Elongate oval.
Y-mark	—
Exoexine (Outer sheath)	
Cappa -dorsal . . .	Non-striate to weakly striate.
-ventral . . .	as for genus.
Cappula	Sacci meet laterally and ventrally leaving simply a linear joint.
Sacci	Disaccate; strongly diploxylonoid; >2 x corpus; slight distal inclination.
Intexine (Inner body)	
Corpus -shape . . .	See notes for genus.
-preserv. . . .	Occasional development of strong transverse medial folds.

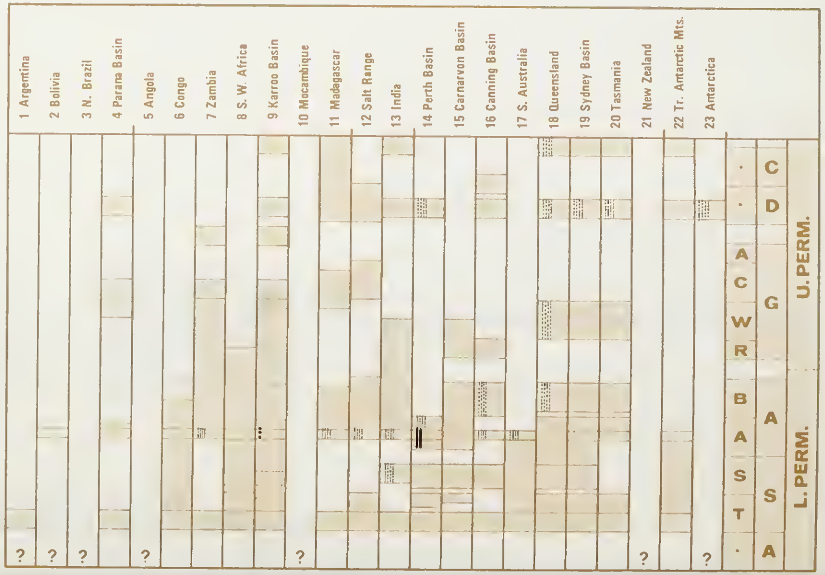
CLOSELY RELATED SPECIES

P.levis	ꝏ; pl.153(3) - pl.152(7).
P.cancellatus	ꝏ; pl.153(2) - pl.157(24).

LITERATURE

7	Zambia . . .	Hart'60, pl.3(37,38).
9	Karroo Basin .	This paper, pl.153(1-18); (Hart'66b).
11	Madagascar . .	Rakoto.'70, pl.17(3,4,7,8,15-17), pl.18(1,2).
12	Salt Range . .	Virk.'46, pl.5(57).
13	India	Virk.'46, pl.12(156); Tiw.'65, pl.5(99-103,108-112). Maithy'65, pl.5(33,34); Bharad. & Tiw.'66, pl.2(13); Mahesh.'67, pl.6(46), pl.8(67); Nav. & Tiw.'68, pl.1(13); Tiw.'68, pl.3(42-45), pl.4(46-53), pl.6(67,68,70-73), pl.8(84-87); Sinha'72, pl.4(47-58); Anand.'72, pl.2(14,15).
	Australia . . .	Balme & Henn.'55, pl.1(6-10); Balme'64, pl.4(19);
14	Perth Basin . .	Segr.'69, pl.9(C); Glick.'72, pl.35(1,2).
16	Canning Basin .	Balme'73, pl.4(18), pl.5(16).
17	S.Australia . .	(Har. & McG.'67).
18	Queensland . .	(Balme & Henn.'55; deJers.'70,'73; Rig.'73).
19	Sydney Basin .	(Balme & Henn.'55).
20	Tasmania . . .	(Balme & Henn.'55; Banks & Naqvi'67).
23	Antarctica . .	(Kemp'69).





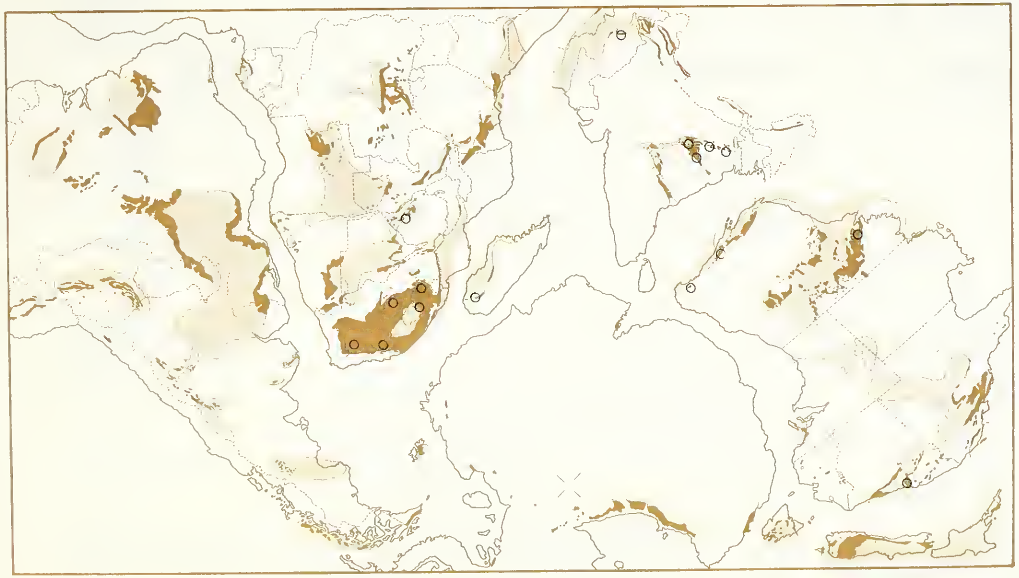
Pityosporites *goraiensis* (Pot. & Lele'61) comb. nov.

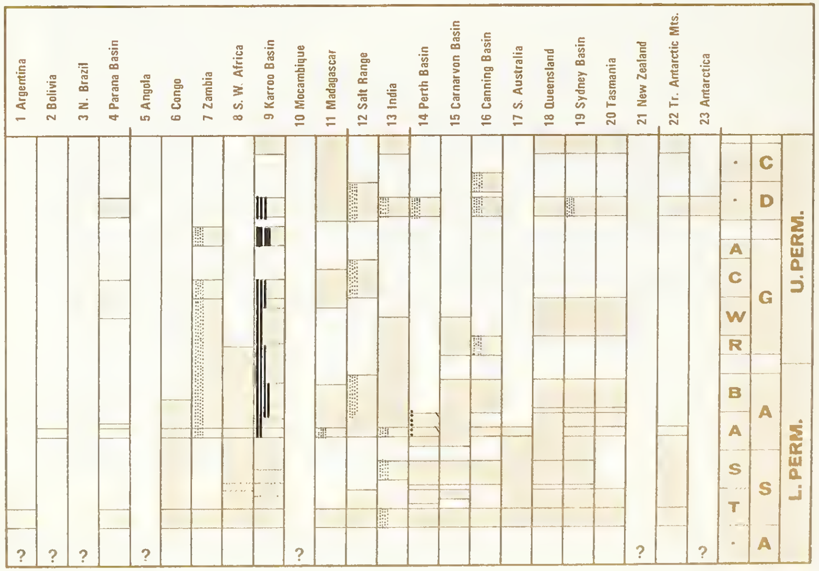
Lunatisporites goraiensis Pot. & Lele'61

REFERENCE POPULATION	This paper, pl.154-155 in full, 99 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, OW, 94, Tapinocephalus Zone equivalent.
HOLOTYPE	Original designation, Pot. & Lele'61, pl.3(70), p.32.
TYPE LOCALITY	India, Madhya Pradesh, South Rewa Basin. Surface locality, N.W. of Goraia village, Talchir Fm.
NAME DERIVATION	After Goraia village.
DESCRIPTION (ref. pop.)	
Overall grain	
Size	32(62)92.
Shape	Oval (broadly oval) circular.
Y-mark	—
Exoexine (Outer sheath)	
Cappa -dorsal	Striate (3 per 20mu); often oblique.
-ventral	as for genus.
Cappula	Sacci meet laterally and ventrally leaving simply a linear joint.
Sacci	Disaccate; haploxylonoid; ¾ x corpus; slight distal inclination.
Intexine (Inner body)	
Corpus -shape	See notes for genus.
-preserv.	Development of strong transverse distal folds.
CLOSELY RELATED SPECIES	
P.ovatus	ↀ ; pl.154(16) - pl.142(43).
P.maximus	ↀ ; pl.154(41) - pl.148(6).
P.amplus	OO; pl.154(39) - pl.162(5).

LITERATURE

7	Zambia	Falc.'72, pl.6(6-11), pl.7(2,3,6).
9	Karroo Basin	This paper, pl.154-156 in full.
11	Madagascar	Rakoto.'70, pl.19(11-13), pl.20(1-5).
12	Salt Range	Balme'70, pl.10(1-3,6-8).
13	India	Pot. & Lele'61, pl.3(70-72); Bharad.'62, pl.17(226-228); Bharad. & Sal.'65a, pl.2(42-44); Tiw.'65, pl.6(128), pl.7(151,152); Maithy'65, pl.6(40); Bharad. & Tiw.'66, pl.2(11); Bharad.'66, pl.4(45); Nav. & Tiw.'67, pl.10(1); Venk. & Kar68a, pl.8(139); Sinha'72, pl.7(103-106).
14	Perth Basin	Segr.'69, pl.7(G,H), pl.9(D-I); Glick.'72, pl.31(7-9), pl.37(1-5).
16	Canning Basin	Balme'73, pl.1(6).
19	Sydney Basin	Helby'70, pl.38(2).





Pityosporites cancellatus (Balme & Henn.'55) comb. nov.

Lueckisporites cancellatus Balme & Henn.'55

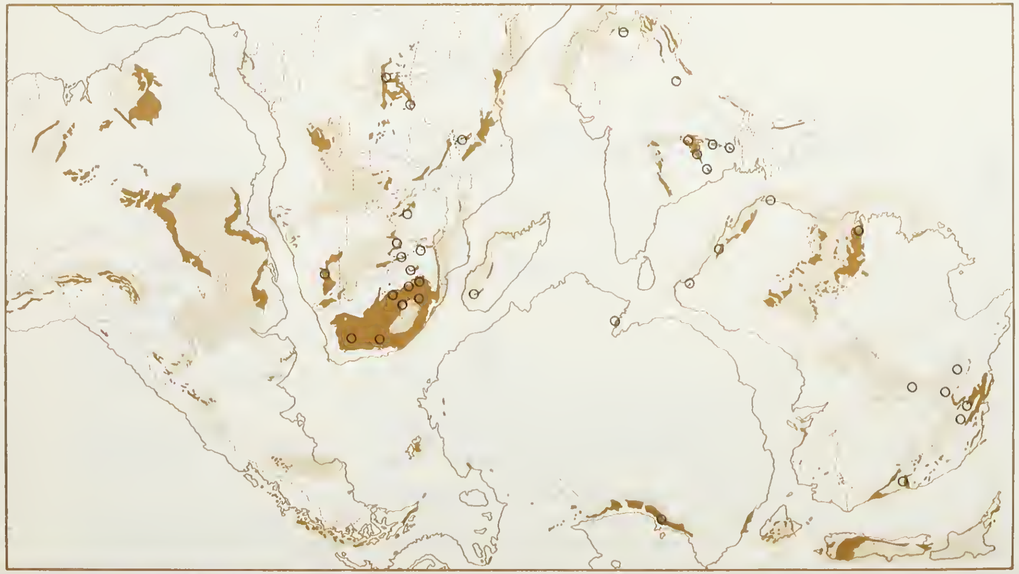
REFERENCE POPULATION	This paper, pl.157(1-26), 26 specimens.
REFERENCE LOCALITY	S.Africa, central Transvaal, Springbok Flats. Surface locality, HKr., M.Ecca.
HOLOTYPE	Not designated to date.
TYPE LOCALITY	N.S.W., Sydney Basin. Borehole, S.Wallarah No.5, seam at 377', Newcastle C.M.
NAME DERIVATION	L. cancellare = to strike out; (? striated cappa).
DESCRIPTION (ref. pop.)	
Overall grain	
Size	42(80)98.
Shape	Elongate oval.
Y-mark	—
Exoexine (Outer sheath)	
Cappa -dorsal	Striate (5 per 20mu), weakly to strongly intrareticulate.
-ventral	as for genus.
Cappula	Parallel sided, 10mu broad.
Sacci	Disaccate; strongly diploxylonoid; 2 x corpus; slight distal inclination.
Intexine (Inner body)	
Corpus -shape	See notes for genus.
-preserv.	Occasional development of strong transverse medial folds.

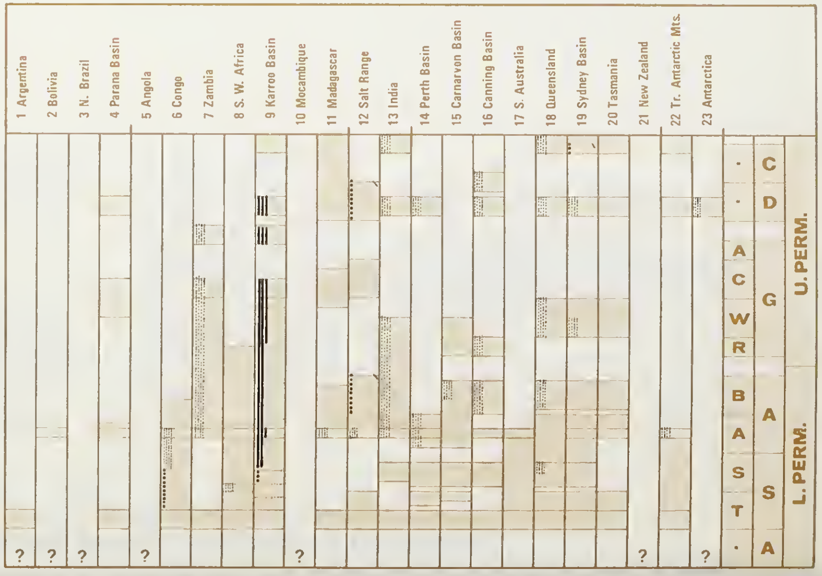
CLOSELY RELATED SPECIES

P.fusus	⚭; pl.157(24) - pl.153(2).
P.amplus	⚭; pl.157(18) - pl.159(1).

LITERATURE

6	Congo	Hoeg & Bose'60, pl.35(1-3); Bose & Kar'66, pl.33(14,15); Bose & Mahesh.'68, pl.17(7), pl.20(1), pl.22(1).
7	Zambia	Hart'60, pl.1(5,6,10); Falc.'72, pl.9(1-11), pl.10(1-6).
8	S.W.Africa	Lesch.'69, pl.4(29).
9	Karroo Basin	This paper, pl.157, 158 in full; (Hart'66b).
11	Madagascar	Rakoto.'70, pl.20(10-13), pl.21(3-5).
12	Salt Range	Virk.'46, pl.5(60), pl.6(85,86), pl.7(93,94,96); Lak. et. al.'60, pl.1(14); Venk. & Kar'68b, pl.4(37-39), pl.5(52-55); Balme'70, pl.12(1-3,10-12).
13	India	Virk.'46, pl.13(164,168,174,175); Bharad.'62, pl.8(119-124), pl.9-13 in full; Bharad. & Sal.'64, pl.5(84-89), pl.609 in full; Bharad. & Sal.'65a, pl.2(32,33,45); Tiw.'65, pl.5(104,105), pl.6(120-127,131,132,138), pl.7(148-150); Bharad. et al.'65, pl.3(22); Sal.'65, pl.2(27); Bharad. & Tiw.'66, pl.2(14); Bharad.'66, pl.5(52,53,55); Kar'66, pl.2(23,25,30,35); Mahesh.'67, pl.4(34), pl.6(49-52), pl.7(54,58), pl.9(70); Nav. & Tiw.'67, pl.9(5-8); Venk. & Kar'68a, pl.5(87), pl.6 in full, pl.7(113-129), pl.9(164,166,167); Kar'68a, pl.3(59-61,64-66); Tiw.'68, pl.5(54-57); Kar.'68c, pl.1(16); Bharad. & Sriv.'69a, pl.25(25-27); Sriv.'70, pl.1(13-15); Sinha'72, pl.5(71,74-76), pl.6(77-89), pl.7(96,99); Anand.'72, pl.1(7,8); Sarb.'72, pl.3(1-3).
	Australia	Balme & Henn.'55, pl.2(11-15), pl.4(36-38); Balme'64, pl.4(7).
14	Perth Basin	Balme'52, fig.49(P38 B); Segr.'69, pl.12(A,B,F-H), pl.13(A-D); Glick.'72, pl.36(6,7), pl.38(1-9).
15	Carnarvon Basin	(Balme'67).
16	Canning Basin	Balme'73, pl.1(8,9,15,16), pl.3(18).
18	Queensland	Hill & Woods'63, pl.15(4-7); deJers.'70, pl.7(7); (Evans'64a,c,'66a,b,c,'67a; Pat.'65; Norv.'71; Rig.'73).
19	Sydney Basin	Helby'70, pl.36(6-12); (Balme & Henn.'55; Evans'67b).
22	Tr.Antarctic Mts.	(Kyle'73 letter).
23	Antarctica	Balme & Playf.'67, pl.2(1-4).





Pityosporites amplus (Balme & Henn.'55) comb. nov.

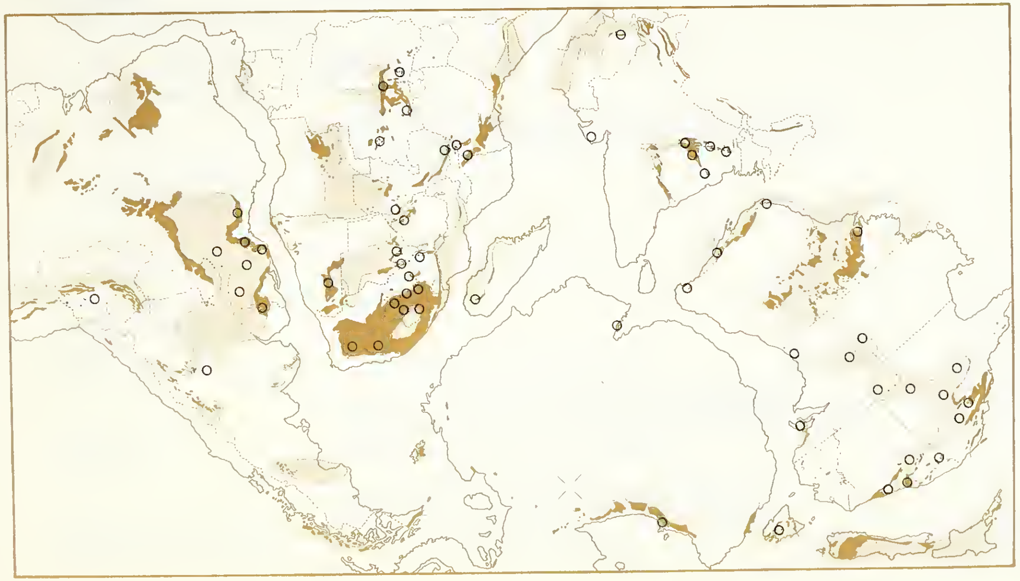
Lueckisporites amplus Balme & Henn.'55

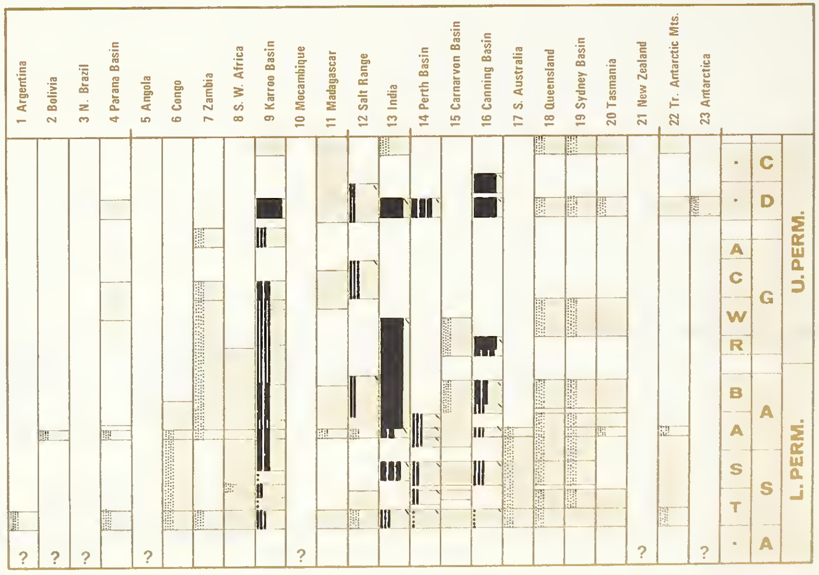
REFERENCE POPULATION	This paper, pl.159-162 in full, 76 specimens.
REFERENCE LOCALITY	S.Africa, central Transvaal, Springbok Flats. Surface locality, HKr., M.Ecca.
HOLOTYPE	Not designated to date.
TYPE LOCALITY	N.S.W., Sydney Basin. Borehole, S.Wallarah No.5, seam at 688', Newcastle C.M.
NAME DERIVATION	L. amplus = wide; (overall size).
DESCRIPTION (ref. pop.)	
Overall grain	
Size	46(100)120.
Shape	Elongate oval.
Y-mark	—
Exoexine (Outer sheath)	
Cappa -dorsal	Striate (3 to 4 per 20mu).
-ventral	as for genus.
Cappula	Parallel sided, 15mu broad.
Sacci	Disaccate; diploxylonoid; 1 x corpus; slight distal inclination.
Intexine (Inner body)	
Corpus -shape	See notes for genus.
-preserv.	Development of strong transverse medial folds.

CLOSELY RELATED SPECIES

P.goraiensis	OO;	pl.162(5) - pl.154(39).
P.cancellatus	ꝏ ;	pl.159(1) - pl.157(18).
P.micros	ꝏ ;	pl.160(1) - pl.173(1).
L.asulcus	OO;	pl.169(3) - pl.178(22).

1	Argentina	Menend.'69, pl.2(11); Menend.'71, pl.4(1,2).
2	Bolivia	Cousm.'65, pl.129(3).
4	Parana Basin	Tiw. & Nav.'67, pl.2(27); Bharad.'69, pl.2(37,38); Daem. & Quad.'70, pl.5(P-383,A,B); Kemp (in press), pl.1(26-29).
6	Congo,	Pier.'59, pl.9(1,4), pl.10(1,2); Hoeg & Bose'60, pl.35(6-8); Bose & Kar'66, pl.16(1,2), pl.17(10), pl.27(1-14), pl.33(7-12); Kar & Bose'67, pl.9(1-5); Bose & Mahesh.'68, pl.18(1-3,9), pl.19(1-4), pl.20(2), pl.21(1-5); Mahesh. & Bose'69, pl.7(10-14), pl.8(2,6).
7	Zambia	Hart'60, pl.1(7,8,13); Falc.'72, pl.6(1-5), pl.8(1-8), pl.9(12-17); (Pant.'58a,b; Pant. & Naut.'60; Townr.'62; Utt.'70).
8	S.W.Africa	Lesch.'59, pl.3(24);
9	Karroo Basin	This paper, pl.159-172 in full; (Hart'66b).
11	Madagascar	Rakoto.'70, pl.17(13,14), pl.19(1-3,8-10), pl.20(14), pl.21(1,2,7,8).
12	Salt Range	Venk. & Kar'68b, pl.5(57-59); Balme'70, pl.10(4,5,9,10), pl.11(1-3), pl.12(7-9); Kemp (in press), pl.2(11).
13	India	Pot. & Lele'61, pl.3(66-69); Bharad.'62, pl.14-16 in full, pl.17(218-225), pl.18(229-236), pl.19(239-248); Bharad. & Sal.'64, pl.10(138-143), pl.11(148-152); Bharad. & Tiw.'64b, pl.1(18), pl.2(22,25,27); Bharad. & Sal.'65a, pl.2(35-38,40,41); Tiw.'65, pl.5(106), pl.6(137,139,140-142), pl.7(143-147,153-155); Bharad. et al.'65, pl.3(21,23,24); Sal.'65, pl.2(26,28,29); Maithy'65, pl.5(32,35-37), pl.6(3,9); Bharad. & Tiw.'66, pl.1(10), pl.2(12); Nav. & Tiw.'66, pl.2(18,20); Bharad.'66, pl.2(22), pl.4(43), pl.5(54,56-59); Kar'65, pl.2(21,26,27); Mahesh.'67, pl.4(33), pl.5(45), pl.6(50), pl.7(55-57,59-61), pl.8(63); Nav. & Tiw.'67, pl.9(4), pl.10(3); Venk. & Kar'68a, pl.7(130,131), pl.8(132-138); Kar'68a, pl.2(55,56); pl.3(67-76); Tiw.'68, pl.5(61,62,69); Bharad. & Sriv.'69a, pl.25(22,23,27-31,33), pl.26(34-36,41,42); Maithy'69, pl.3(15); Venk.'70, pl.1(5); Kar'70, pl.2(38-42,45,46); Saks.'71, pl.7(75,76,79,81); Lele & Karim'71, pl.3(32); Sinha'72, pl.7(93-95, 97,98,100-102); Anand.'72, pl.1(9,10), pl.2(11,12); Sarb.'72, pl.2(4-7), pl.3(4-6); Pant. & Bhat.'73, pl.1(3,5), pl.2(1-14).
	Australia	Balme & Henn.'55,pl.2(23), pl.3(24-32), pl.4(33-35,41,42); Balme'64, pl.3(15), pl.4(6,8,15).
14	Perth Basin	Segr.'69, pl.8(E), pl.9(B); Segr.'72, pl.4(9); Glick.'72, pl.36(1-5), pl.39(1-9).
15	Carnarvon Basin	(Balme'67).
16	Canning Basin	Balme'73, pl.1(10,12,13,18,20), pl.3(16,21), pl.4(15), pl.5(12), pl.6(8); (Balme'68).
17	S.Australia	Evans'64, pl.2(19-25), pl.3(26-32); (Har. & Lud.'66; Har. & McG.'67,'71).
18	Queensland	Hill & Woods'63, pl.15(1,3); deJers.'70, pl.8(5); (Evans'64a,c,'66a,b,c,'67a; Pat.'65,'69; Burg.'70; Norv.'71; Rig.'73).
19	Sydney Basin	Helby'70, pl.28(4), pl.34(8-15); (Balme & Henn.'55; Evans'67b; McK. & Gut.'69).
20	Tasmania	(Balme & Henn.'55; Banks & Naqvi'67).
22	Tr.Antarctic Mts.	(Kyle'73 letter; Bar. & Kyle (In press))
23	Antarctica	Balme & Playf.'67, pl.1(15,18-20); (Kemp'69).





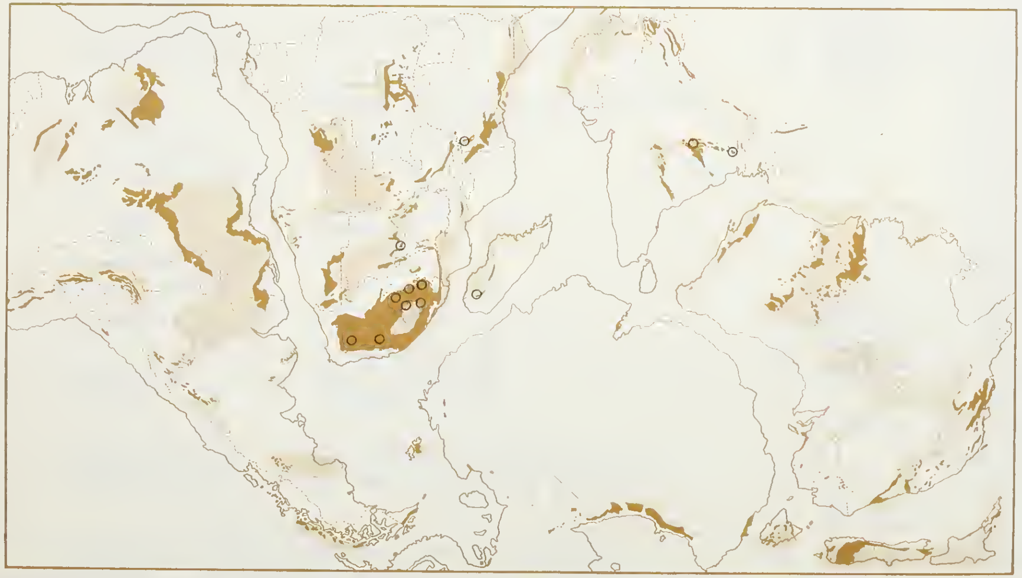
Pityosporites micros (Hart'63) comb. nov.

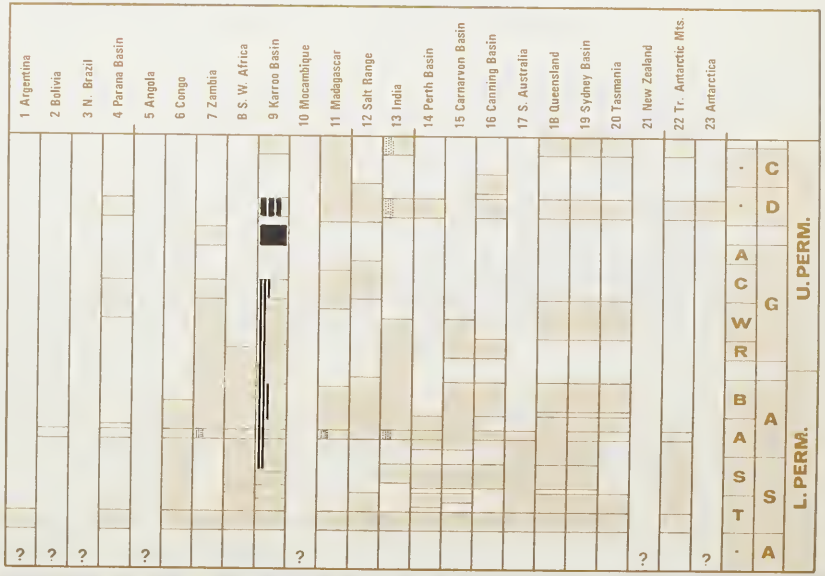
Striatopinites micros Hart '63

REFERENCE POPULATION	This paper, pl.173(1-47), 47 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Oliviershoek Pass area. Surface locality, Kb, L.Beaufort (Daptocephalus Zone).
HOLOTYPE	Original designation, Hart '63b, pl.I(4), p.9.
TYPE LOCALITY	Tanzania, Ruhuhu Valley, Ketewaka-Mchuchuma Coalfield. Surface locality, Mchuchuma River valley, assemblage 60, K2 C.M.
NAME DERIVATION	Gr. micros = small; (relative overall size).
DESCRIPTION (ref. pop.)	
Overall grain	
Size	40(47)54.
Shape	Elongate oval (oval) broadly oval.
Y-mark	—
Exoexine (Outer sheath)	
Cappa -dorsal	Striate (5 per 20 mu).
-ventral	as for genus.
Cappula	Sacci meet laterally and ventrally leaving simply a linear joint.
Sacci	Disaccate; haploxylonoid; ¾ x corpus; slight distal inclination.
Intexine (Inner body)	
Corpus -shape	See notes for genus.
-preserv.	Development of strong transverse medial folds.
CLOSELY RELATED SPECIES	
P.amplus	OD; pl.173(1) - pl.160(1).
P.varimicros	OD; pl.174(17) - pl.174(26).

LITERATURE

7	Zambia	Hart'63b, pl.1(4,7).
9	Karroo Basin	This paper, pl.173(1-47), pl.174(1-25); (Hart'66b).
11	Madagascar	Rakoto.'70, pl.19(4-7), pl.20(6-8).
13	India	Tiw.'65, pl.7(157-159); Sal.'65, pl.2(30-32); Bharad. & Sriv.'69a, pl.26(37,39).



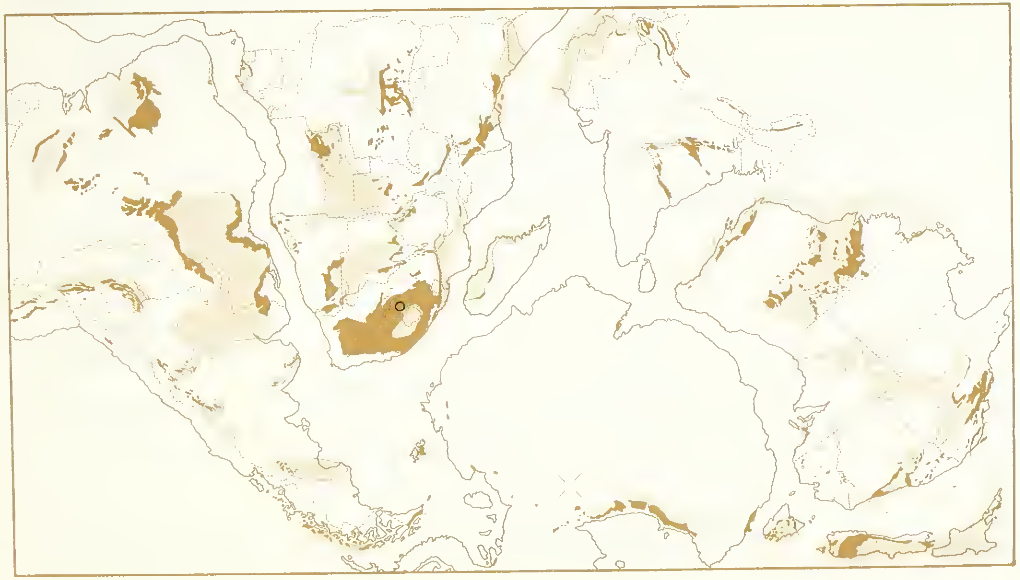


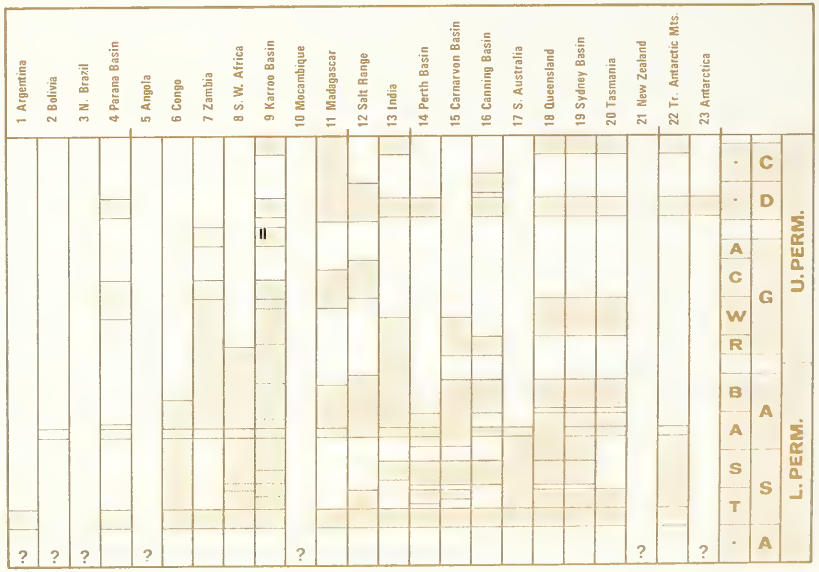
Pityosporites varimicros sp. nov.

REFERENCE POPULATION .	This paper, pl.174(26-37), 12 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, OW, 94', Tapinocephalus Zone equivalent.
HOLOTYPE	This paper, pl.174(35).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION . . .	L. varius = various; Gr. mikros = small; (relationship to *P.micros*).
DESCRIPTION (ref. pop.)	
Overall grain	
Size	40(44)48.
Shape	Elongate oval.
Y-mark	—
Exoexine (Outer sheath)	
Cappa -dorsal . . .	Striate (8 per 20mu); very slightly intrareticulate.
-ventral . . .	as for genus.
Cappula	Sacci meet laterally and ventrally leaving simply a linear joint.
Sacci	Disaccate; slightly diploxylonoid; 1 x corpus; slight distal inclination.
Intexine (Inner body)	
Corpus -shape . . .	See notes for genus.
-preserv. . . .	Development of strong transverse distal folds.
CLOSELY RELATED SPECIES	
P.micros	ⓄD; pl.174(26) - pl.174(17).

LITERATURE

9	Karroo Basin	This paper, pl.174(26-38).





Lueckisporites asulcus (Bose & Kar'66) comb. nov.

Strotersporites asulcus Bose & Kar'66

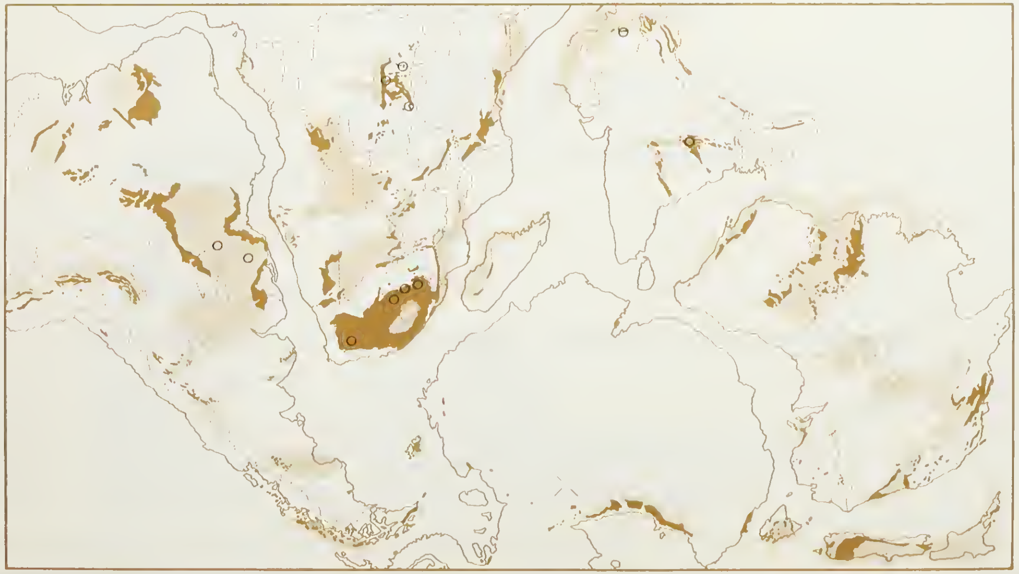
REFERENCE POPULATION .	This paper, pl.175-177 in full, 43 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, OW, 94', Tapinocephalus Zone equivalent.
HOLOTYPE	Original designation, Bose & Kar '66, pl.27(7), p.105.
TYPE LOCALITY	Congo, Walikale region. Surface locality, Mabuita, Assise des schistes noirs de Walikale.
NAME DERIVATION . . .	Gr. a . . . = in . . ., un . . .; L. sulcus = furrow; ("sulcus hardly perceptible" - Bose & Kar'66).
DESCRIPTION (ref. pop.)	
Overall grain	
Size	90(100)112.
Shape	Elongate oval.
Y-mark	—
Exoexine (Outer sheath)	
Cappa -dorsal . . .	Distinct; traverses ⅗ length of grain; striate (3 per 20mu); prominent central cleft dividing cappa into 2 broad ribs.
-ventral . . .	Cappa restricted to dorsal surface.
Cappula	Roughly rectantular in side and ventral view (ranging from ± 8mu broad near equator to ± 14mu broad at ventral pole).
Sacci	Disaccate; slightly diploxylonoid; saccus 2 x cappa rib; slight distal inclination.
Intexine (Inner body)	
Corpus -shape . . .	Oval.
-preserv. . . .	Indistinct or lost.

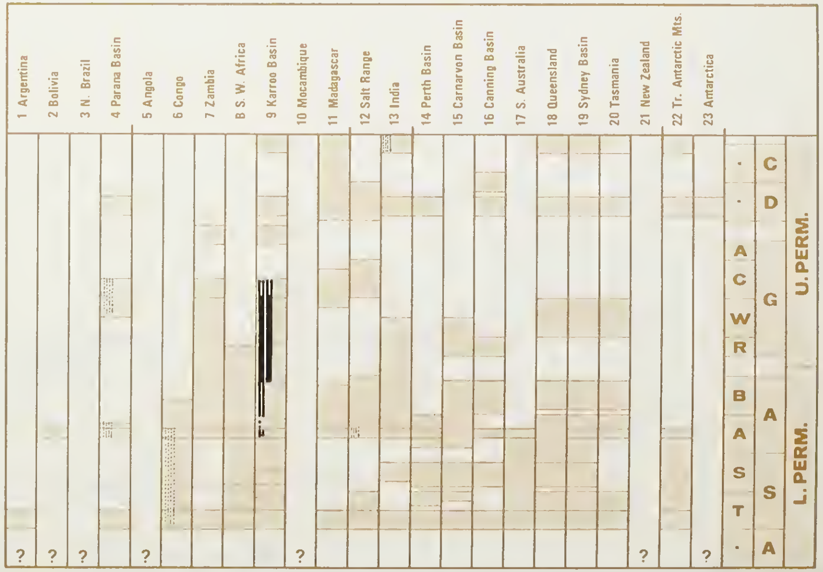
CLOSELY RELATED SPECIES

P.amplus	OO; pl.178(22) - pl.169(3).
L.nyakapendensis . . .	Φ ; pl.175, 176, 177(in full) - pl.179(in full).
L.welkomensis	OO; pl.178(8) - pl.182(4).

LITERATURE

4	Parana Basin . .	Daem. & Quad.'70, pl.8(P-306,A,B).
6	Congo	Hoeg & Bose'60, pl.30(4-7); Bose & Kar'66, pl.26(11), pl.27(1,2,6-8,10), pl.33(7-13); Kar & Bose'67, pl.8(10,12), pl.9(1); Bose & Mahesh.'68, pl.18(4-7); Mahesh.'69, pl.5(6).
9	Karroo Basin .	This paper, pl.175-178 in full.
12	Salt Range . .	Virk.'46, pl.5(56,58); Venk. & Kar'66b, pl.1(6).
13	India	Bharad. & Sriv.'69a, pl.25(32), pl.26(41).





Lueckisporites nyakapendensis Hart'60

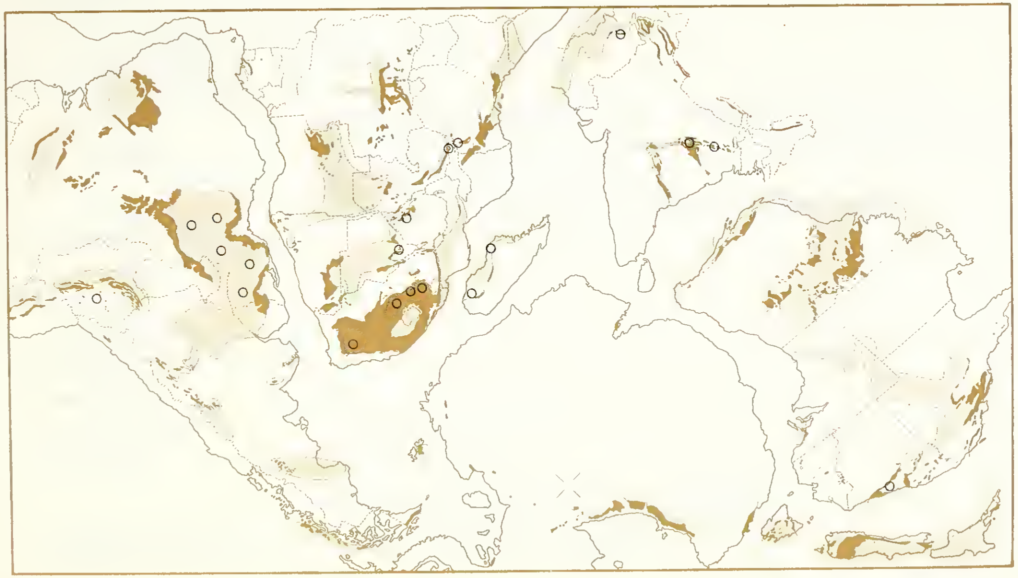
REFERENCE POPULATION .	This paper, pl.179(1-30), 30 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, OW, 94', Tapinocephalus Zone equivalent.
HOLOTYPE	Original designation, Hart'60, pl.1(12), p.9.
TYPE LOCALITY	Tanzania, Ruhuhu Valley, Ketewaka-Mchuchuma Coalfield. Surface locality, Nyakapenda River valley, coal 3' from top of C.S. 34 ('Middle seam') of McKinlay, K2 C.M.
NAME DERIVATION . . .	After Nyakapenda River valley.
DESCRIPTION (ref. pop.)	
Overall grain	
Size	52(80) 104.
Shape	Elongate oval.
Y-mark	–
Exoexine (Outer sheath)	
Cappa -dorsal . . .	Distinct, traverses ⅗ length of grain; non-striate but for prominent central cleft dividing cappa into 2 broad ribs.
-ventral . . .	Cappa restricted to dorsal surface.
Cappula	Roughly rectangular in side and ventral view (ranging from ± 8mu broad near equator to ± 14mu broad at ventral pole.
Sacci	Disaccate; slightly diploxylonoid; saccus 2 x cappa rib; slight distal inclination.
Intexine (Inner body)	
Corpus -shape . . .	Oval.
-preserv. . . .	Indistinct or lost.

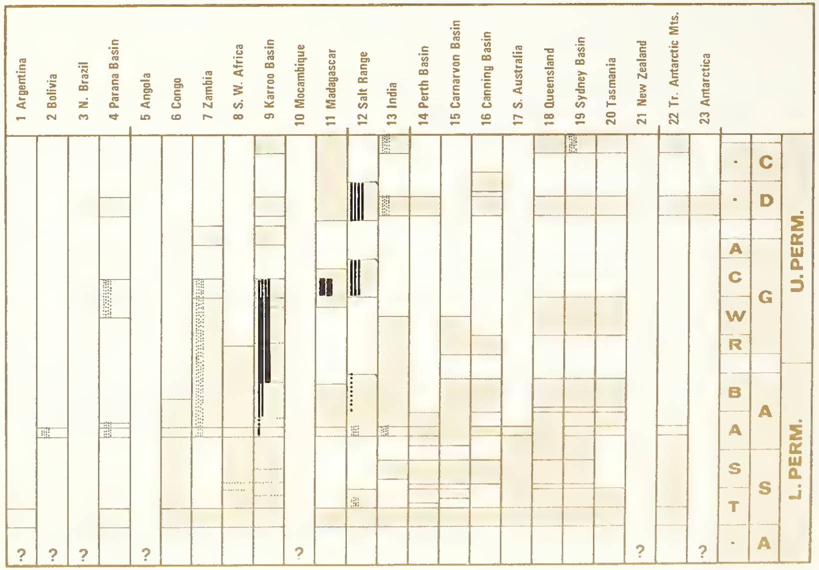
CLOSELY RELATED SPECIES

L.asulcus	$\underline{\Phi}$; pl.179(in full) - pl.175,176,177(in full).
L.welkomensis	$\underline{OO}$; pl.180(5) - pl.182(1).

LITERATURE

2	Bolivia . . .	Cousm.'65, pl.129(1,2,4-10), pl.130(1,2).
4	Parana Basin .	Daem. & Quad.'70, pl.9(P-325,A-F, P-310,A-C).
6	Congo . . .	Bose & Mahesh.'68, pl.17(6), pl.18(5).
7	Zambia . . .	Hart'60, pl.1(11,12); Hart'69, pl.1(9,10); Falc.'72, pl.11(1-4); (Utt.'70)
9	Karroo Basin .	Hart'69, pl.1(6,8); This paper, pl.179-181 in full; (Hart'66b).
11	Madagascar . .	Jek. & Goub.'64, fig.5(1020); Goub.'65, pl.1(7).
12	Salt Range . .	Virk.'46, pl.1(4,5), pl.3(31-33); Venk. & Kar'66b, pl.1(5,10); Balme'70, pl.13(1-5).
13	India	Tiw.'65, pl.6(119); Venk. & Kar'68c, pl.1(15); Kar'68c, pl.1(11,12); Bharad. & Sriv.'69a, pl.24(12-17); Anand.'72, pl.2(20); Sinha'72, pl.5(61-65).
19	Sydney Basin .	Helby'70, pl.28(1-3).





Lueckisporites welkomensis sp. nov.

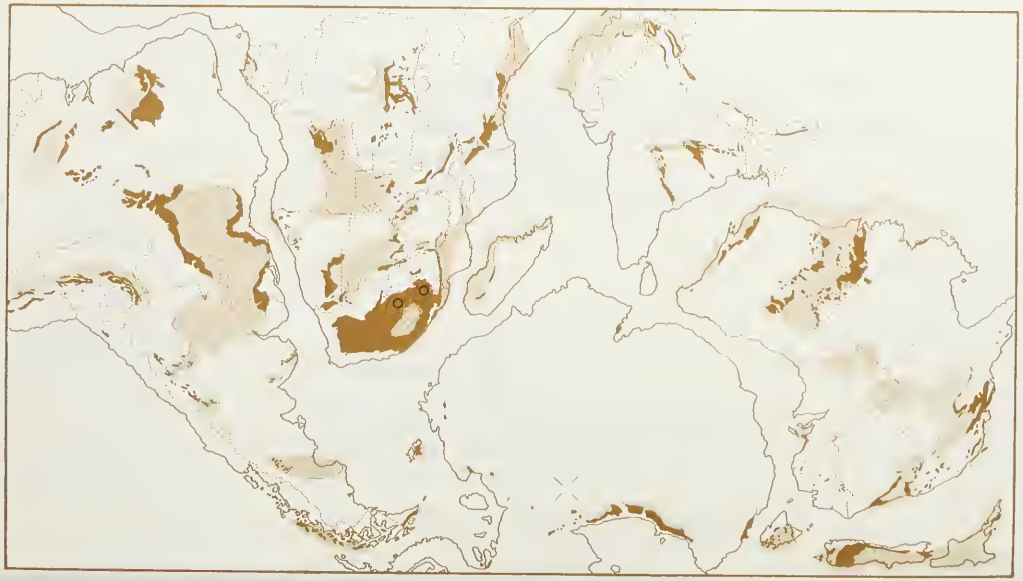
REFERENCE POPULATION .	This paper, pl.182(1-17), 17 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1007'6" to 1017', M.Ecca equivalent.
HOLOTYPE	This paper, pl.182(11).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION . . .	After Welkom (town in O.F.S.).
DESCRIPTION (ref. pop.)	
Overall grain	
Size	68(100)116.
Shape	Oval.
Y-mark	–
Exoexine (Outer sheath)	
Cappa -dorsal . . .	Distinct; traverses ⅘ length of grain; non-striate but for prominent central cleft dividing cappa into 2 broad ribs.
-ventral . . .	Cappa restricted to dorsal surface.
Cappula	Roughly rectangular in side and ventral view (ranging from ± 8mu broad near equator to ± 14mu broad at ventral pole.
Sacci	Disaccate; slightly diploxylonoid; saccus 1 x cappa rib, slight distal inclination.
Intexine (Inner body)	
Corpus -shape . . .	Oval.
-preserv. . . .	Distinct, unfolded, never lost.

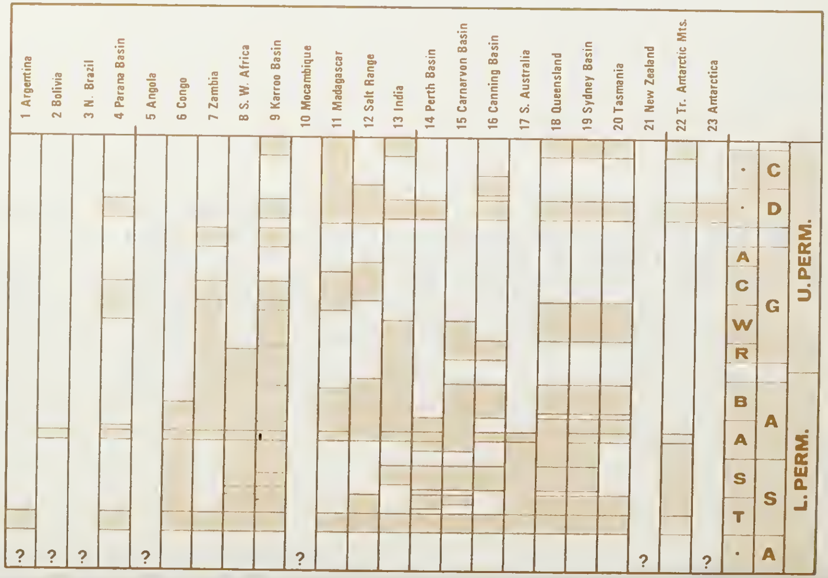
CLOSELY RELATED SPECIES

L.asulcus	OO; pl.182(4) - pl.178(8).
L.nyakapendensis . . .	OO; pl.182(1) - pl.180(5).
L.hannonicus	OO; pl.182(1) - pl.183(4).

LITERATURE

9	Karroo Basin	Hart '69, pl.1(1,7); This paper, pl.182(1-22).





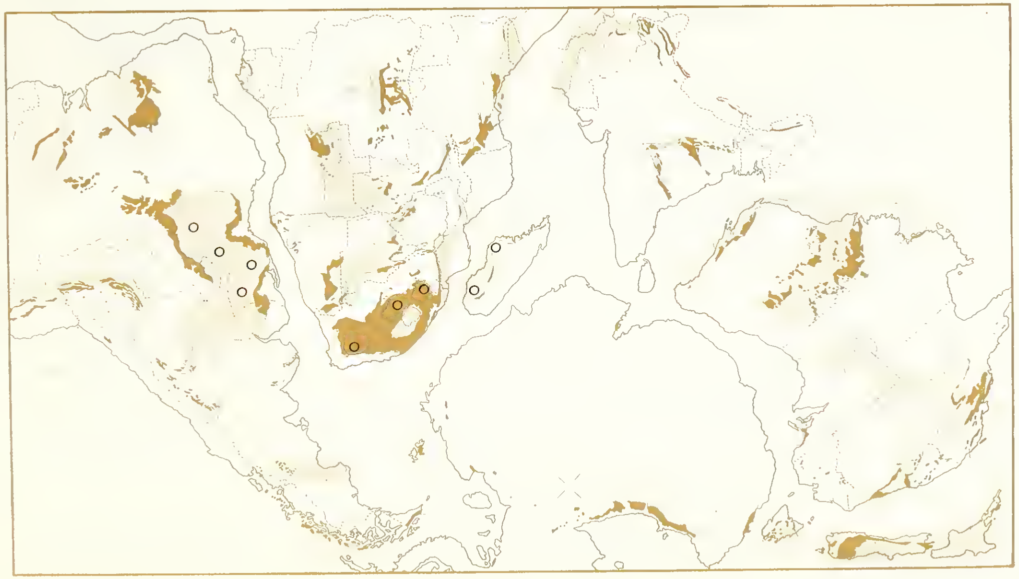
Lueckisporites hannonicus (Goub.'65) comb. nov.

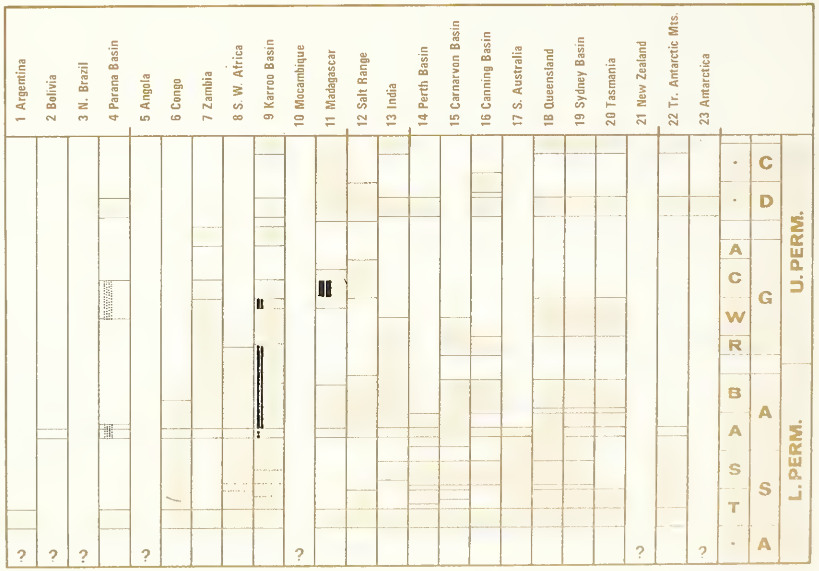
Guttulapollenites hannonicus Goub.'65

REFERENCE POPULATION	This paper, pl.183(1-9), 9 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, SAP 6, 1000' to 1019', M.Ecca equivalent.
HOLOTYPE	Original designation, Goub.'65, pl.6(5,6), p.1431.
TYPE LOCALITY	Madagascar, Morondava Basin. Borehole, LW1, 349m., 'Permien superieur'.
NAME DERIVATION	After Hannonis in Madagascar.
DESCRIPTION (ref. pop.)	
Overall grain	
Size	46(53)60.
Shape	Circular.
Y-mark	–
Exoexine (Outer sheath)	
Cappa -dorsal	Distinct; traverses almost full lenth of grain; non-striate but for prominent central cleft dividing cappa into 2 broad ribs.
-ventral	Cappa restricted to dorsal surface.
Cappula	Reduced to a linear cleft between the 2 sacci.
Sacci	Disaccate; haploxylonoid; saccus 1 x cappa rib; medium distal inclination.
Intexine (Inner body)	
Corpus -shape	Circular.
-preserv.	Indistinct or lost.
CLOSELY RELATED SPECIES	
L.welkomensis	OO; pl.183(4) - pl.182(1).

LITERATURE

4	Parana Basin	Daem. & Quad.'70, pl.9(P-537,A,B).
9	Karroo Basin	This paper, pl.183(1-12).
11	Madagascar	Goub.'65, pl.6(5-10).





Lueckisporites neohannonicus sp. nov.

REFERENCE POPULATION	This paper, pl.183(13-29), 17 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, OW, 94', Tapinocephalus Zone equivalent.
HOLOTYPE	This paper, pl.183(20).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION	Gr. neo = new; hannonicus (after Honnonis in Madagascar).

DESCRIPTION (ref. pop.)

Overall grain	
Size	34(50)60.
Shape	Circular.
Y-mark	—
Exoexine (Outer sheath)	
Cappa -dorsal	Distinct; traverses full length of grain and extends down either end to partially occupy the ventral surface; non-striate but for prominent central cleft dividing cappa into 2 broad ribs.
-ventral	Cappa extends down either end to partially occupy the ventral surface.
Cappula	Reduced to a linear cleft between the 2 sacci.
Sacci	Sacci reduced to 2 broad ribs identical in appearance (size, shape and texture) to the cappa ribs; haploxylonoid; saccus 1 x cappa rib; strong distal inclination.
Intexine (Inner body)	
Corpus -shape	Circular.
-preserv.	Completely enclosed and hidden by sacci and cappa ribs.

CLOSELY RELATED SPECIES

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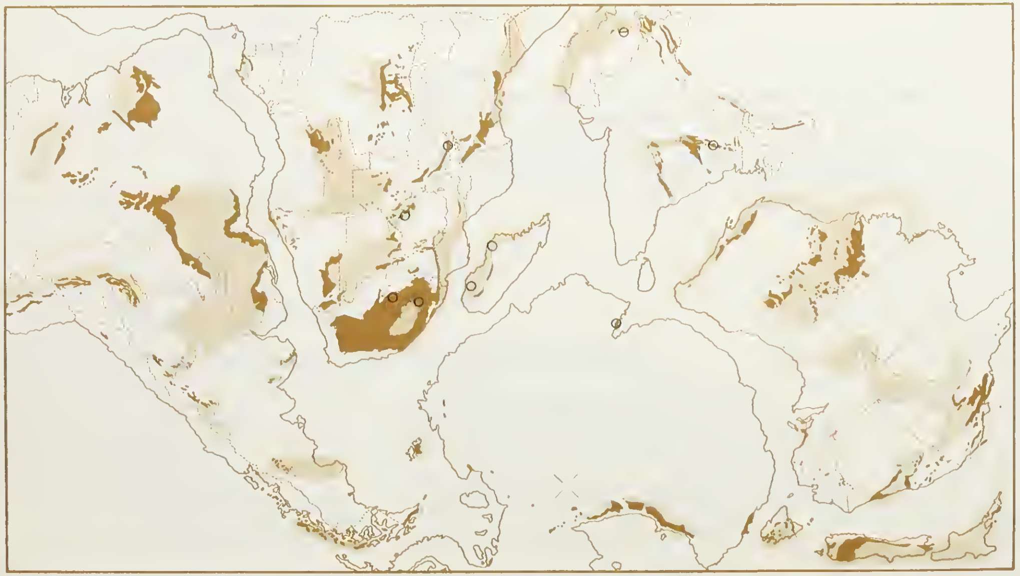
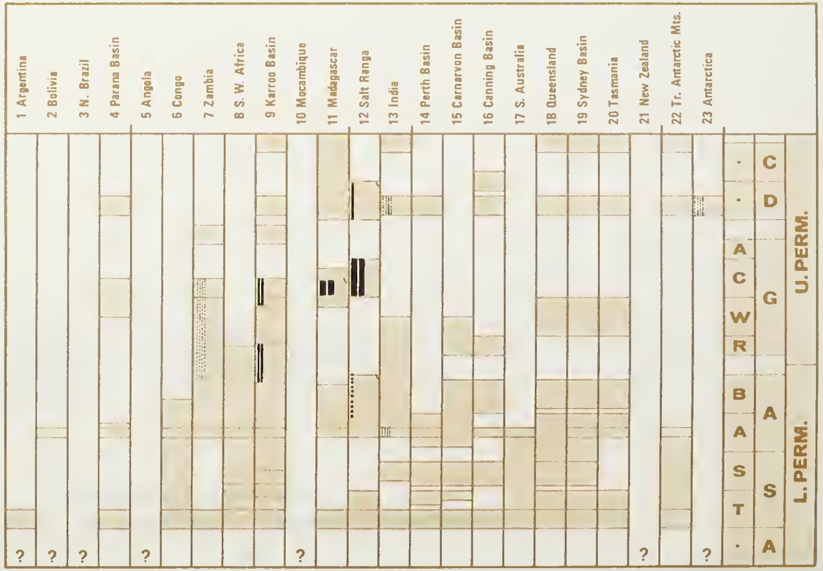
LITERATURE

7	Zambia	Falc.'72, pl.11(11-13); (Utt.'70).
9	Karroo Basin	Hart'69, pl.1(2-5); This paper, pl.183(13-38).
11	Madagascar	Jek. & Goub.'64, fig.5(1002,1034,1077).
12	Salt Range	Balme'70, pl.14(4-7).
13	India	Venk. Goub & Kar'67, pl.1(1-15); Venk. & Kar68a, pl.10(191-199); Kar'68c, pl.1(23,24).
23	Antarctica	(Kemp'69).





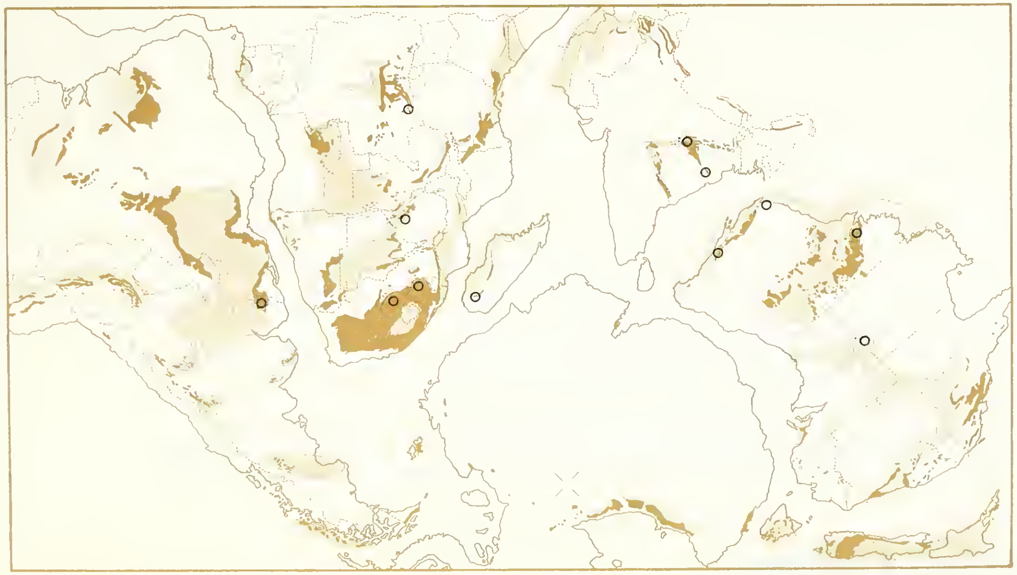
Cycadopites cymbatus (Balme & Henn.'56) Hart'65

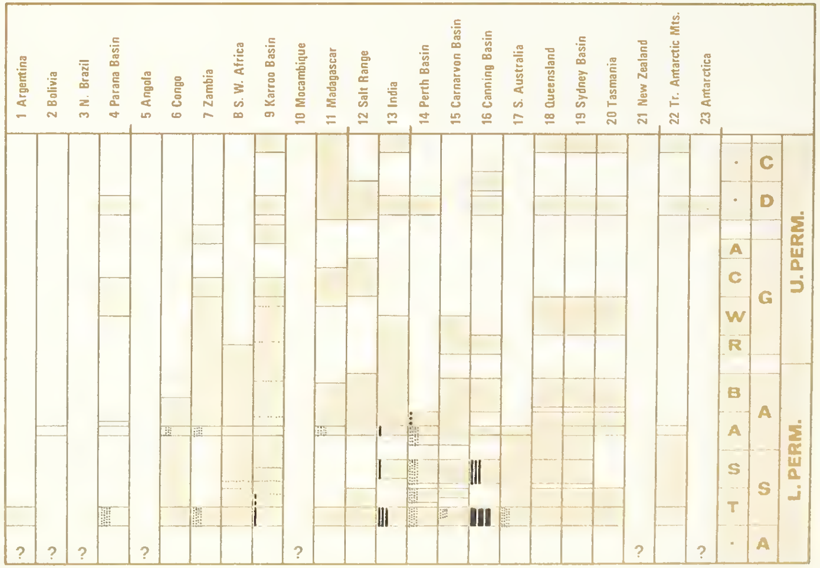
Entylissa cymbatus Balme & Henn.'56

REFERENCE POPULATION	This paper, pl.184(1-9), 9 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Welkom/Virginia area. Borehole, UC 729, 550,0m., Dwyka Tillite.
HOLOTYPE	Not designated to date.
TYPE LOCALITY	N.S.W., Sydney Basin. Hebburn No.1 Colliery, Homeville seam, Lower Split, Greta C.M.
NAME DERIVATION	Gr. kymbion (L. cymbium) = cup, bowl; (general appearance).
DESCRIPTION (ref. pop.)	See notes for genus.
CLOSELY RELATED SPECIES	—

LITERATURE:

4	Parana Basin	Bharad.'69, pl.2(48-50).
6	Congo	Mahesh. & Bose'69, pl.9(1-5).
7	Zambia	Falc.'72, pl.5(31,32).
9	Karroo Basin	This paper, pl.184(1-20).
11	Madagascar	Rakoto.'70, pl.22(6-14).
13	India	Pot. & Lele'61, pl.3(85-97); Tiw.'65, pl.9(209,212-217); Bharad.'66, pl.1(12,13); Sriv.'70, pl.2(25,26); Tiw. & Moiz'71, pl.1(19-26), pl.2(27-31).
	Australia	Balme & Henn.'56a, pl.3(51,53-56); Balme'64, pl.3(8).
14	Perth Basin	Segr.'70, pl.11(E).
15	Carnarvon Basin	(Balme'67).
16	Canning Basin	Balme'73, pl.6(2), pl.8(9); (Balme'68).
17	S.Australia	Evans'64b, pl.1(15-18).





Pinuspollenites thoracatus Balme'70

REFERENCE POPULATION .	This paper, pl.184(21-32), 12 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Greylingstad/Bethal/Hendrina area. Borehole, WV3, 133,50m., M.Ecca.
HOLOTYPE	Original designation, Balme '70, pl.15(12), p.400.
TYPE LOCALITY	West Pakistan, Salt Range. Surface locality, Field no.T62-350, Warchha Water Tank, Amb Fm.
NAME DERIVATION . . .	Gr. thorax = breastplate; (Cappa).
DESCRIPTION (ref. pop.) .	See notes for genus.

CLOSELY RELATED SPECIES

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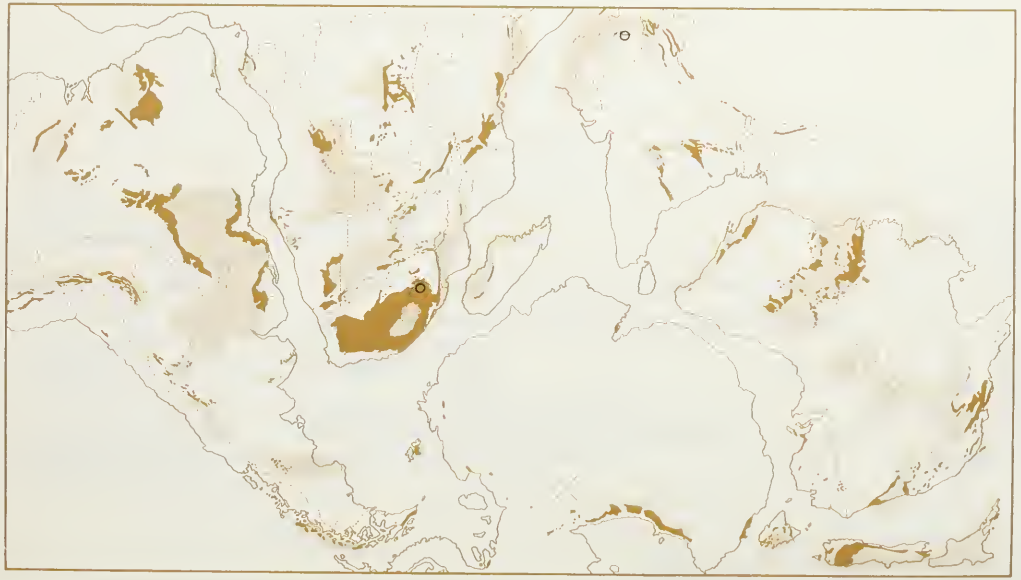
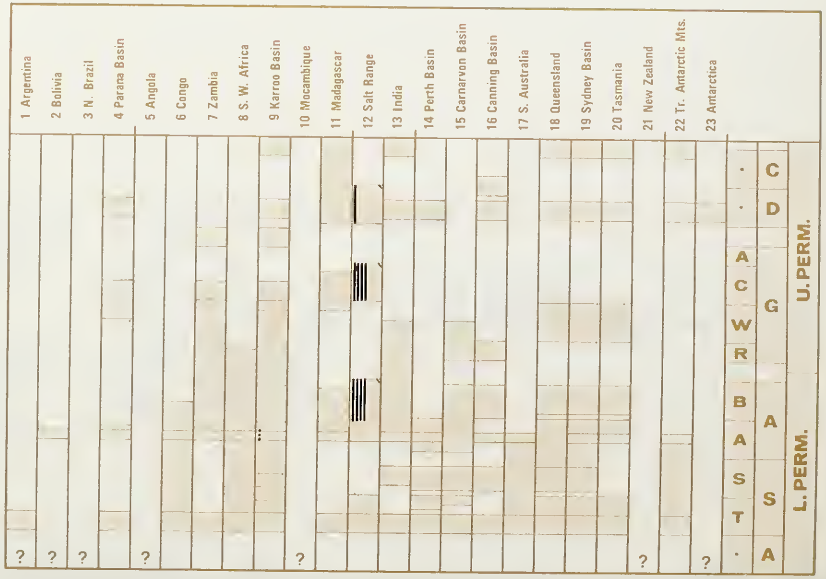
LITERATURE:

9	Karroo Basin .	This paper, pl.184(21-32).
12	Salt Range . .	Balme'70, pl.15(10-14).





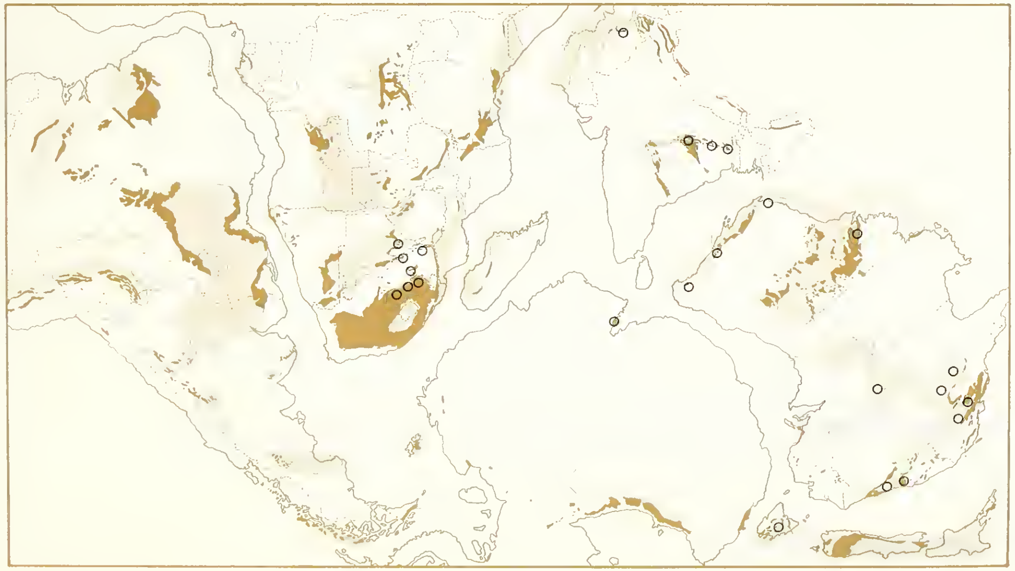
Gnetaceaepollenites sinuosus (Balme & Henn.'56) Bharad.'62

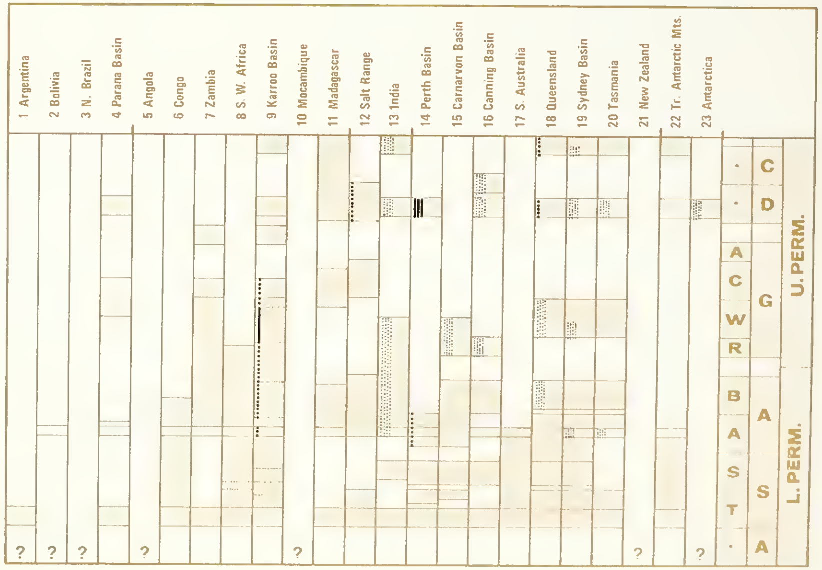
Marsupipollenites sinuosus Balme & Henn.'56

REFERENCE POPULATION	This paper, pl.185(1-14), 14 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Greylingstad/Bethal/Hendrina area. Borehole, UC 678, 79,0m. to 80,6m., M.Ecca.
HOLOTYPE	Not designated to date.
TYPE LOCALITY	N.S.W., Sydney Basin. Borehole, S.Wallarah No.5, seam at 688', Newcastle C.M.
NAME DERIVATION	L. sinuosus = sinuous; (General appearance).
DESCRIPTION (ref. pop.)	
Exine	as for genus.
Shape	Elongate oval.
Longit. folds & ridges	Very prominent.
? Germinal markings	Monolete, frequently obscured.
Ornament. Arrangement	as for genus.
Description	? very densely & finely faveolate.
Size	82(134)186.
CLOSELY RELATED SPECIES	
G.ovatus	OO; pl.185(2) - pl.187(1).

LITERATURE:

9	Karroo Basin	This paper, pl.185,186 in full; (Hart'66b).
12	Salt Range	Balme'70, pl.21(23,24).
13	India	Bharad.'62, pl.5(84-92); Bharad. & Sal.'64, pl.12(164,165,168); Kar'66, pl.2(32,33,40,41); Mahesh.'67, pl.9(72); Venk. & Kar'68a, pl.10(177-182); Kar'68a, pl.4(87-95); Bharad. & Sriv.'69a, pl.29(117-125); Sarb.'72, pl.2(1,2).
	Australia	Balme & Henn.'56a, pl.2(25-28).
14	Perth Basin	Segr.'70, pl.11(J,K); Segr.'72, pl.7(4); Glick.'72, pl.41(6-9).
15	Carnarvon Basin	(Balme'67).
16	Canning Basin	Balme'73, pl.1(17); (Balme'68).
18	Queensland	deJers.'70, pl.9(13); (Evans'64a,b,c,'67a; Pat.'65,'69; Norv.'71; Rig.'73).
19	Sydney Basin	Dulh.'45, pl.7(3B); Helby'70, pl.40(9-15); (Balme & Henn.'56a; Evans'67b).
20	Tasmania	(Balme & Henn.'56a; Banks & Naqvi'67).
23	Antarctica	Balme & Playf.'67, pl.1(10,11); (Kemp'69).



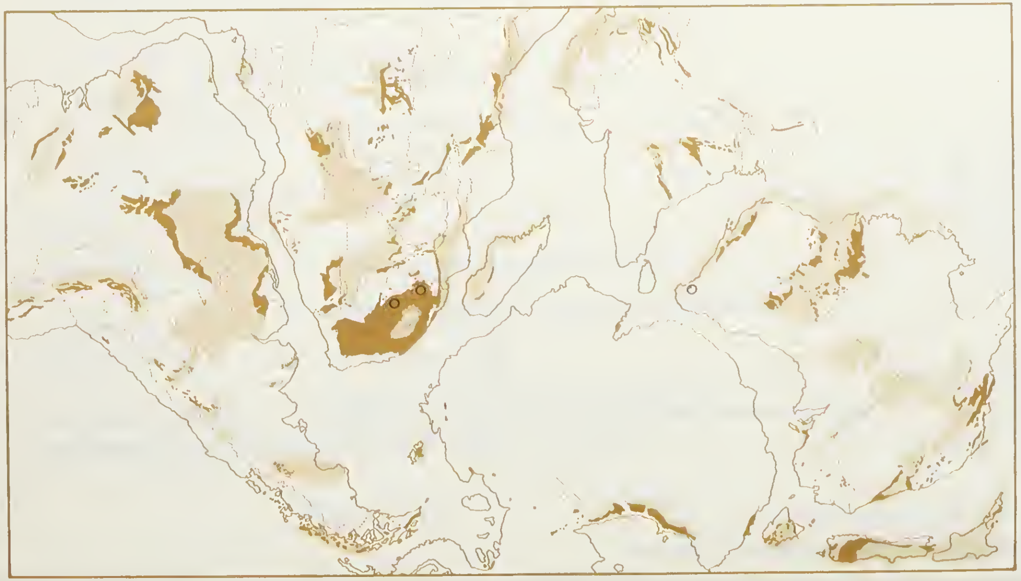


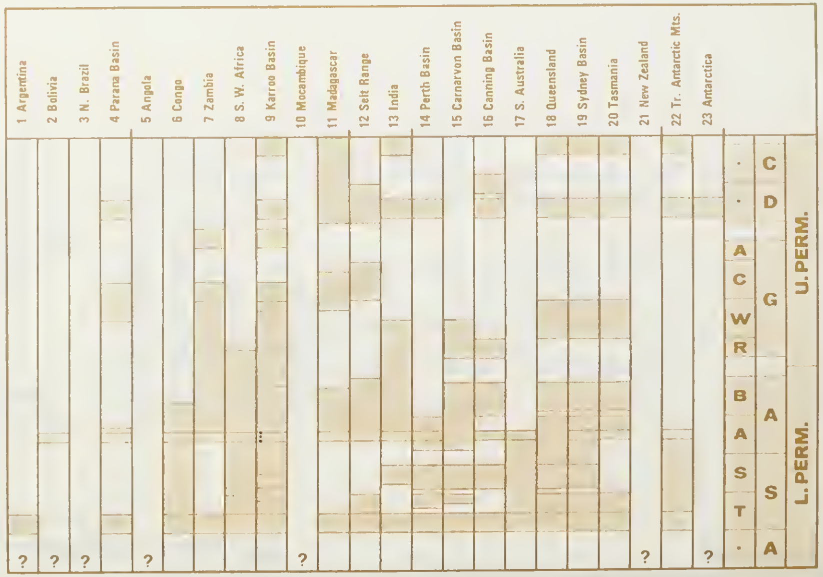
Gnetaceaepollenites ovatus sp. nov.

REFERENCE POPULATION	This paper, pl.187(1-6), 6 specimens.
REFERENCE LOCALITY	S.Africa, northern Karroo Basin, Greylingstad/Bethal/Hendrina area. Borehole, UC 678, 79,0m. to 80,6m., M.Ecca.
HOLOTYPE	This paper, pl.187(3).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION	L. ovatus = oval; (equatorial outline).
DESCRIPTION (ref. pop.)	
Exine	as for genus.
Shape	Oval.
Longit. folds & ridges	Not as prominent as in *G.sinuosus*.
? Germinal markings	Monolete to partially trilete.
Ornament. Arrangement	as for genus.
Description	? very densely & finely foveolate.
Size	82(96)110.
CLOSELY RELATED SPECIES	
G.sinuosus	OO; pl.187(1) - pl.185(2).

LITERATURE:

9	Karroo Basin	This paper, pl.187 in full.
14	Perth Basin	Glick.'72, pl.41(5).





Gnetaceaepollenites bulbiger sp. nov.

REFERENCE POPULATION .	This paper, pl.188(5-8), 4 specimens.
REFERENCE LOCALITY .	S.Africa, northern Karroo Basin, Greylingstad/Bethal/Hendrina area. Borehole, UC 678, 30,6m. to 31,6m., M.Ecca.
HOLOTYPE	This paper, pl.188(5).
TYPE LOCALITY	As for reference locality.
NAME DERIVATION . . .	L. bulbus = bulb; L. gerere = carry; (ornamentation).

DESCRIPTION (ref. pop.)

Exine		as for genus.
Shape		Oval to elongate oval
Longit. folds & ridges . .		Very prominent.
? **Germinal markings** . .		? , obscured
Ornament.	Arrangement	as for genus.
	Description .	Coarsely gemmate.
Size		84(99)114.

CLOSELY RELATED SPECIES

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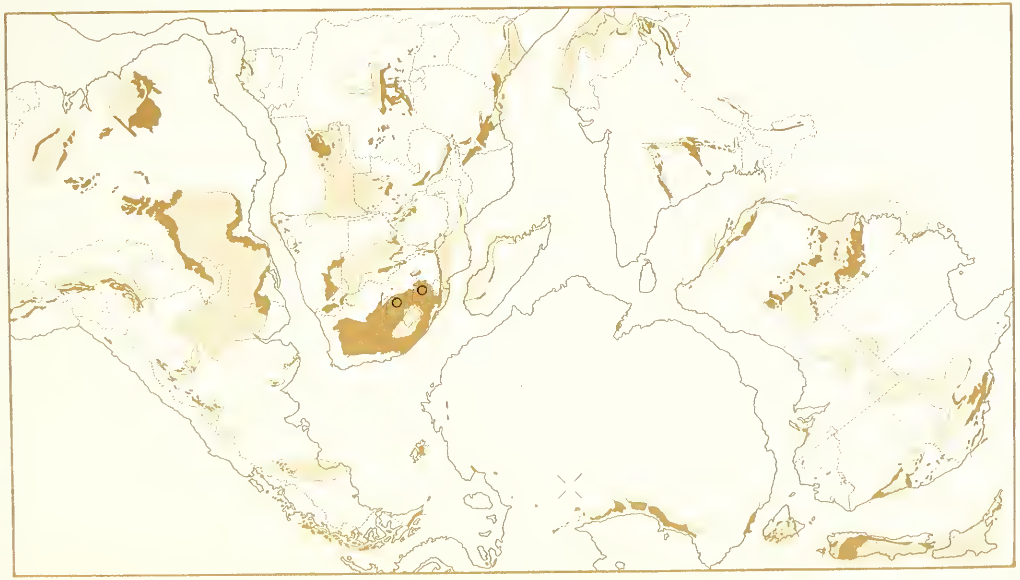
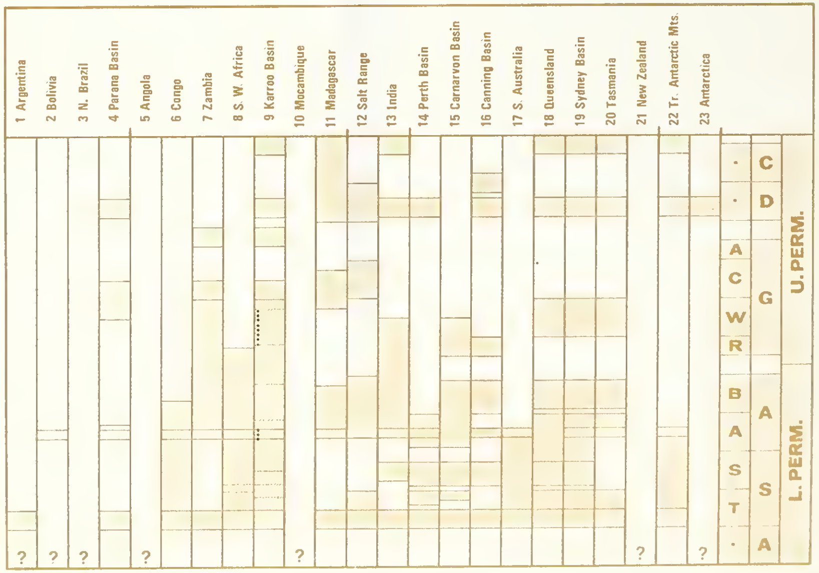
LITERATURE:

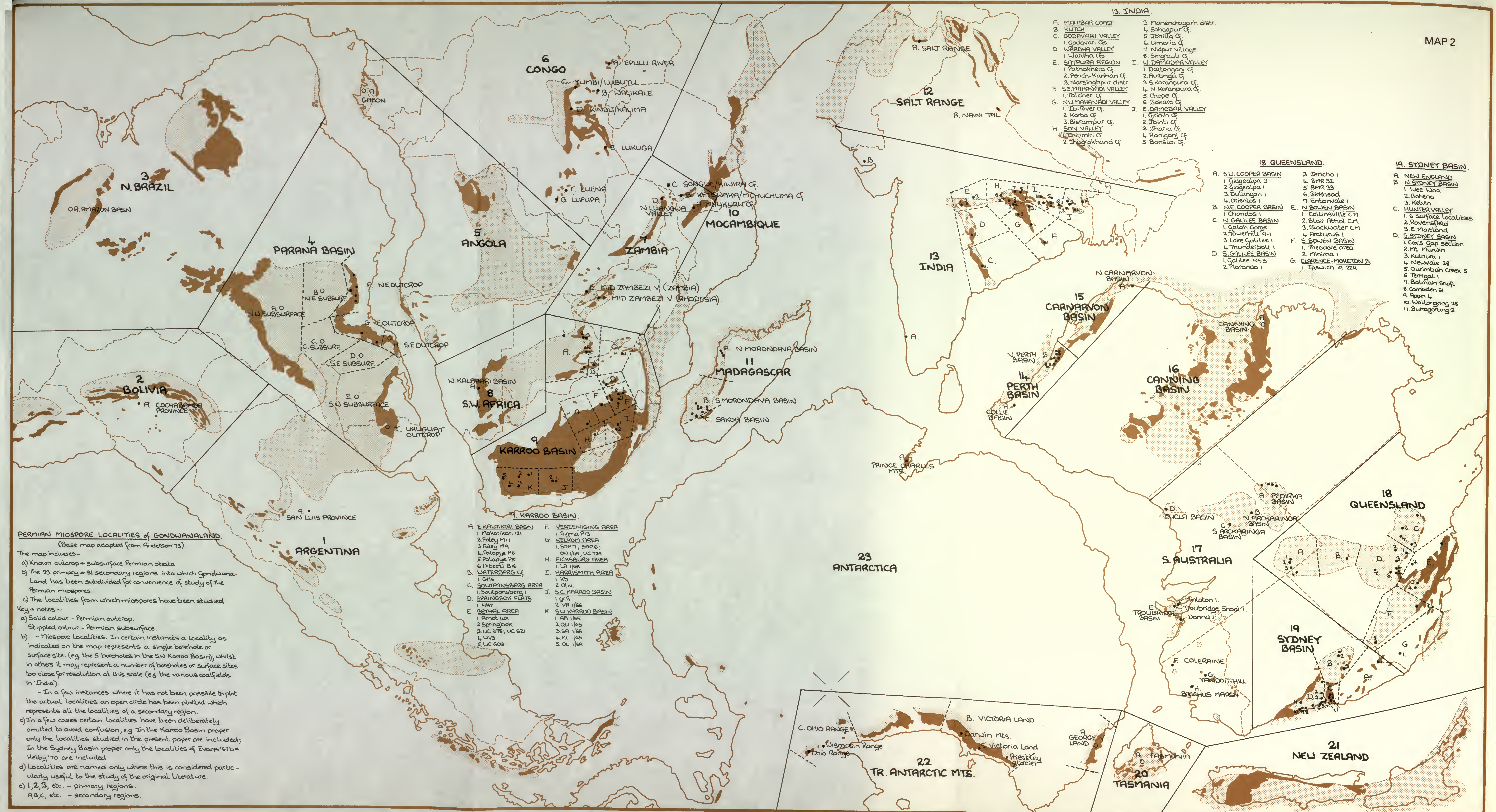
9	Karroo Basin .	This paper, pl.188 in full.





9.4 ANNOTATED BIBLIOGRAPHY

Datta '57	13. India H.
Datta '69	19. Sydney Basin C.
Dev '61	13. India E.
Doub. & Rakato. '60	11. Madagascar C.
Doug '69	17. S. Australia F, G, H.
Dulh. '45	19. Sydney Basin C, D.
Dulh. '46	19. Sydney Basin C, D.
Dulh. & Dulh. '49.	20. Tasmania A.
Evans '64a	18. Queensland C.
Kemp in press	4. Parana Basin, F. G, 12. Salt Range A, 22. Tr. Antarctic Mts. C; General.
Klasz. & Mich. '70	5. Angola A.
Kyle '73	22. Tr. Antarctic Mts. B.
Lak. et. al. '60	12. Salt Range B.
Lele '64	13. India H.
Lele '65	13. India H.
Lele '66	13. India H(2) I, J, general.
Lele & Chand. '72	13. India H(2), general.
	Australasia general.
Segr. '69	14. Perth Basin B.
Segr. '70	14. Perth Basin B.
Segr. '72	14. Perth Basin B.
Sen '44	13. India J.
Sen '53	13. India J.
Sew '14	22. Tr. Antarctic Mts. B.
Sew. '33	22. Tr. Antarctic Mts. B.
Sinha 69	13. India H.



PERMIAN MIOSPORE LOCALITIES of GONDWANALAND.

(Base map adapted from Anderson'73).

The map includes –

a) Known outcrop + subsurface Permian strata.

b) The 23 primary + 81 secondary regions into which Gondwanaland has been subdivided for convenience of study of the Permian miospores.

c) The localities from which miospores have been studied.

Key + notes –

a) Solid colour – Permian outcrop.
Stippled colour – Permian subsurface.

b) – Miospore localities. In certain instances a locality as indicated on the map represents a single borehole or surface site. (e.g. the 5 boreholes in the S.W. Karroo Basin); whilst in others it may represent a number of boreholes or surface sites too close for resolution at this scale (e.g. the various coalfields in India).

– In a few instances where it has not been possible to plot the actual localities an open circle has been plotted which represents all the localities of a secondary region.

c) In a few cases certain localities have been deliberately omitted to avoid confusion, e.g. In the Karroo Basin proper only the localities studied in the present paper are included; In the Sydney Basin proper only the localities of Evans'67b + Helby'70 are included

d) Localities are named only where this is considered particularly useful to the study of the original literature.

e) 1, 2, 3, etc. – primary regions.
A, B, C, etc. – secondary regions.

9. KARROO BASIN.

A. E. KALAHARI BASIN
  1. Makarikari 121
  2. Foley M11
  3. Foley M9
  4. Palapye P6
  5. Palapye P5
  6. Dibeeti B16
B. WATERBERG Cf.
  1. GH6
C. SOUTPANSBERG AREA
  1. Soutpansberg 1
D. SPRINGBOK FLATS
  1. HKr
E. BETHAL AREA
  1. Arnot 401
  2. Springbok
  3. UC 678; UC 621
  4. WV3
  5. UC 608
F. VEREENIGING AREA
  1 Sigma P13
G. WELKOM AREA
  1. SAP 7, SAP 6; OW 1/4A, UC 729.
H. FICKSBURG AREA
  1. LA 1/68
I. HARRISMITH AREA
  1. Kb
  2. Oliv.
J. S.C. KARROO BASIN
  1. Gr.R
  2 VR. 1/66
K. S.W. KARROO BASIN
  1. AB 1/65
  2. QU 1/65
  3. SA 1/66
  4. KL. 1/65
  5. OL. 1/69

13. INDIA.

A. MALABAR COAST
B. KUTCH
C. GODAVARI VALLEY
  1. Godavari Cfs.
D. WARDHA VALLEY
  1. Wardha Cfs.
E. SATPURA REGION
  1. Pathakhera Cf.
  2. Pench-Kanhan Cf.
  3. Narsinghpur distr.
F. S.E. MAHANADI VALLEY
  1. Talcher Cf.
G. N.W. MAHANADI VALLEY
  1. Ib-River Cf.
  2. Korba Cf.
  3. Bisrampur Cf.
H. SON VALLEY
  1. Chirimiri Cf
  2. Jhagrakhand Cf.
  3. Manendragarh distr.
  4. Sohagpur Cf.
  5. Johilla Cf.
  6. Umaria Cf.
  7. Nidpur village
  8. Singrauli Cf.
I. W. DAMODAR VALLEY
  1. Daltonganj Cf.
  2. Auranga Cf
  3. S. Karanpura Cf.
  4. N. Karanpura Cf.
  5. Chope Cf.
  6. Bokaro Cf.
J. E. DAMODAR VALLEY
  1. Giridih Cf.
  2. Jainti Cf.
  3. Jharia Cf.
  4. Raniganj Cf.
  5. Bansloi Cf.

18. QUEENSLAND.

A. S.W. COOPER BASIN
  1. Gidgealpa 3
  2. Gidgealpa 1
  3. Dullingari 1
  4. Orientos 1
B. N.E. COOPER BASIN
  1. Chandos 1
C. N. GALILEE BASIN
  1. Galah Gorge
  2. Towerhill A-1
  3. Lake Galilee 1
  4. Thunderbolt 1
D. S. GALILEE BASIN
  1. Galilee NS 5
  2. Maranda 1
  3. Jericho 1
  4. BMR 32
  5. BMR 33
  6. Birkhead
  7. Entonvale 1
E. N. BOWEN BASIN
  1. Collinsville C.M.
  2. Blair Athol C.M.
  3. Blackwater C.M.
  4. Arcturus 1
F. S. BOWEN BASIN
  1. Theodore area
  2. Minima 1
G. CLARENCE-MORETON B.
  1. Ipswich 19-22R

19. SYDNEY BASIN.

A. NEW ENGLAND
B. N. SYDNEY BASIN
  1. Wee Waa
  2. Bohena
  3. Kelvin
C. HUNTER VALLEY
  1. 6 surface localities
  2. Ravensfield
  3. E. Maitland
D. S. SYDNEY BASIN
  1. Cox's Gap section
  2. Mt. Murwin
  3. Kulnura 1
  4. Newvale 28
  5. Ourimbah Creek 5
  6. Terrigal 1
  7. Balmain Shaft
  8. Cambden 61
  9. Appin 4
  10. Wollongong 28
  11. Burragorang 3

Alphabetical list of references (according to author)

Anand. '72a	13. India D, E.
Anand. '72b	13. India D, E
And. This paper	9. Karroo Basin D, E, F, G, H, I, J, K; General
And. & And. '70	General.
Balme '52	14. Perth Basin A.
Balme '57	17. S. Australia C.
Balme '62	22. Tr. Antarctic Mts. B.
Balme '64.	Australasia general.
Balme '67	15. Carnarvon Basin A.
Balme '68.	16 Canning Basin A.
Balme '70	12. Salt Range A.
Balme '73	16. Canning Basin A.
Balme & Henn. '55	Australasia general.
Balme & Henn. '56a	Australasia general.
Balme & Henn. '56b	Australasia general.
Balme & Playf. '58	23. Antarctica A.
Balme & Playf. '67	23. Antarctica A.
Balme & Segr. '66	14. Perth Basin B.
Bandyo. '69a	13. India I, J, general.
Bandyo. '69b	13. India J.
Baner. '58	13. India I.
Banks '62	20 Tasmania A
Banks & Naqvi '67	20. Tasmania A.
Bar. & Kyle (in press)	22. Tr. Antarctic Mts. B.
Bharad. '62	13. India J.
Bharad '66	13. India general.
Bharad '69	4. Parana Basin I; General
Bharad. '70	13. India general.
Bharad. '72	13. India general.
Bharad. & Anand. '72	13. India I.
Bharad. et. al. '65	13. India J.
Bharad. & Sal. '64	13. India J.
Bharad. & Sal. '65a	13. India J.
Bharad. & Sal. '65b	13. India J.
Bharad. & Sinha '69a	13. India H.
Bharad & Sinha '69b	13. India H.
Bharad & Sriv. '69a	13. India H.
Bharad. & Sriv. '69b	13. India H.
Bharad. & Sriv. '69c	13. India F.
Bharad. & Sriv. '69d	13. India F, G, H(2), general.
Bharad. & Sriv. '70	13. India G.
Bharad. & Sriv. '71	13. India H.
Bharad. & Sriv. '73	13. India G.
Bharad. & Riw. '64a	13. India G, I, general.
Bharad. & Tiw. '64b	13. India G.
Bharad. & Tiw. '66	13. India I
Bharad. & Tiw. '68	13. India I.
Bhatt. '59	13. India I.
Bhatt. et. al. '57	13. India I, J(2), general.
Bose '71	6. Congo general
Bose & Kar '66	6. Congo B, C, D.
Bose & Kar '67	6. Congo E, F.
Bose & Mahesh. '66	6. Congo A.
Bose & Mahesh. '68	6. Congo E.
Burg. '70	18. Queensland C.
Chand. et. al. '64	13. India general
Chand. & Sats. '65	13. India H.
Cousm. '65	2. Bolivia A.
Crid. '63	22. Tr. Antarctic Mts. C.
Crohn '59	23. Antarctica A.
Daem. & Contr. ?'73	3. N. Brazil A
Daem. & Quad. '73	4. Parana Basin A, B, C, D, E.
Das '58	13. India F.
Datta '57	13. India H.
Datta '69	19. Sydney Basin C.
Dev '61	13 India E.
Doub. & Rakato. '60	11. Madagascar C.
Doug '69	17. S. Australia F, G, H.
Dulh. '45	19. Sydney Basin C, D.
Dulh. '46	19. Sydney Basin C, D.
Dulh. & Dulh. '49.	20. Tasmania A.
Evans '64a	18. Queensland C.
Evans '64b	17. S. Australia A.
Evans '64c	18. Queensland general.
Evans '66a	18. Queensland C, D.
Evans '66b	18. Queensland E.
Evans '66c	18. Queensland A, B.
Evans '67a	- Australasia general.
Evans '67b	19. Sydney Basin, B, C, D.
Evans '69	Australasia general.
Falc. '72	7. Zambia F.
Falc. '73	7. Zambia F.
Falc. in press a	7. Zambia F.
Falc. in press b	7. Zambia F
Gang '59	13. India H.
Ghosh '65	13. India J.
Ghosh et. al. 47	13. India I.
Ghosh & Sen. '48	13. India J.
Glick. '72	14. Perth Basin A.
Gosw. '50	13. India H.
Gosw. '51	13. India H.
Goub. '65	11. Madagascar A, B.
Guhas. '56	13. India J.
Har. & Lud. '66	17. S. Australia D.
Har. & McG. '68	17. S. Australia B.
Har. & McG. 71.	17. S. Australia E.
Hart '60	7. Zambia B.
Hart '62	7. Zambia B.
Hart '63a	9. Karroo Basin G.
Hart '63b	7. Zambia B. General
Hart '64a	9. Karroo Basin G.
Hart '64b	7. Zambia B, C.
Hart '65a	General.
Hart '65b	9. Karroo Basin F.
Hart '66a	9. Karroo Basin A, B, C, D, E, F, G.
Hart '66b	9. Karroo Basin general.
Hart '69a	9. Karroo Basin F.
Hart '69b	9. Karroo Basin F, G.
Hart '69c	General.
Hart '70a	General.
Hart '70b	
Helby '70	19. Sydney Basin D.
Helby & McC. in press	Australasia general.
Henn. '58	19. Sydney Basin D.
Hill & Woods '63	18. Queensland D.
Hoeg & Bose '60	6. Congo B, E, F, G.
Jard. '69	5. Angola A.
Jek & Goub. '63	11. Madagascar A, B.
Jek. & Goub. '64	11. Madagascar A, B.
Jek. et al. '60	11. Madagascar A, B.
de Jers. '46	18. Queensland E.
de Jers. '70	18. Queensland F.
de Jers. '73	18 Queensland G.
Kar '66	13. India J.
Kar '67	6. Congo general.
Kar '68a	13. India J.
Kar '68b	13. India J.
Kar '68c	13. India I
Kar '69a	13. India I.
Kar '69b	13. India I.
Kar '69c	6. Congo D.
Kar '70a	13. India J.
Kar '70b	13. India J.
Kar '73	13. India I.
Kar & Bose '67	6. Congo E.
Kemp '69	23. Antarctica A.
Kemp in press	4. Parana Basin, F. G; 12. Salt Range A; 22. Tr. Antarctic Mts. C; General.
Klasz. & Mich. '70	5. Angola A.
Kyle '73	22. Tr. Antarctic Mts. B.
Lak. et. al. '60	12. Salt Range B.
Lele '64	13. India H.
Lele '65	13. India H.
Lele '66	13. India H(2) I, J, general.
Lele & Chand. '72	13. India H(2), general.
Lele & Chand. '73	13. India H.
Lele & Karim '71	13. India J.
Lele & Kulk. '69	13. India I.
Lele & Maithy '64	13. India J.
Lele & Maithy '69	13. India H.
Lesch. '59	8. S. W. Africa A.
Machiav. '63	4. Parana Basin I.
Mahesh. '66	13. India J.
Mahesh. '67	13. India J.
Mahesh. '69	6. Congo G.
Mahesh. & Bose '69	6. Congo E.
Mahesh. & Kar '67	13. India I.
Maithy '65	13. India J.
Maithy '66a	13. India H
Maithy '66b	13. India general.
Maithy '68	13. India H.
Maithy '69a	13. India I.
Maithy '69b	13. India general.
Maithy '71	13. India I.
Marq. '70	4. Parana Basin I.
McK. & Gut. '69	19. Sydney Basin A.
Mehta '44	13. India H.
Menend. '69	1. Argentina A.
Menend. '71	1. Argentina A.
Nav. '66	13. India F.
Nav. & Sriv. '71	13. India F.
Nav. & Sriv. '72	13. India J.
Nav. & Tiw. '66	13. India F.
Nav. & Tiw. '67	13. India H.
Nav. & Tiw. '68	13. India G.
Norv. '71	18. Queensland C.
Pant '42	17. S. Australia H.
Pant '43	17. S. Australia H.
Pant '49	17. S. Australia H.
Pant '55	17. S. Australia H.
Pant '58a	7. Zambia A; 19. Sydney Basin C; General.
Pant '58b	7. Zambia A.
Pant & Bhat. '73	13. India J.
Pant & Mehra '63	17. S. Australia H.
Pant & Naut. '60	13. India J.
Pant & Sriv. '65	4. Parana Basin H.
Pat. '65	18. Queensland E.
Pat. '69	18. Queensland A.
Pav. '58	22. Tr. Antarctic Mts A.
Pier '59	6. Congo F.
Pier. in press	6. Congo F.
Plum. '57	9. Karroo Basin E.
Plum. '66	9. Karroo Basin E, F, G.
Pot. '56	19. Sydney Basin C, D.
Pot. & Lele '61	13. India H.
Pot. & Sah '60	13. India A.
Rakoto. '60	11. Madagascar C.
Rakoto. '70	11. Madagascar C.
Rakoto. '72	11. Madagascar C.
Rig '73	18. Queensland D.
Rig. & Schopf '69	22. Tr. Antarctic Mts. C.
Ril. '54	9. Karroo Basin I.
Saks. '71	13. India H.
Sal. '65	13. India J.
Sarb. '72	13. India J.
Sats. et. al. '68	13. India J.
Schopf '62	22. Tr. Antarctic Mts. C.
Schopf '64	22. Tr. Antarctic Mts. C.
Segr. '67	14. Perth Basin B; 16. Canning Basin A; Australasia general.
Segr. '69	14. Perth Basin B.
Segr. '70	14. Perth Basin B.
Segr. '72	14. Perth Basin B.
Sen '44	13. India J.
Sen '53	13. India J.
Sew. '14	22. Tr. Antarctic Mts. B.
Sew. '33	22. Tr. Antarctic Mts. B.
Sinha 69	13. India H.
Sinha '72	13. India H.
Sith. et. al. '54	12. Salt Range B.
Sriv. '55	13. India J.
Sriv. '70	13. India F.
Sriv. & Pawde '62	13. India J.
Sur. '58	13. India J.
Sur. in press.	13. India general.
Sur. & Lele '56	13. India J.
Sur. et al. '53	13. India I.
Thierg. & Frantz '62	13. India C.
Tiw. '64	13. India G, 1, general.
Tiw. '65	13. India G, I, general.
Tiw. '68a	13. India G.
Tiw. '68b	13. India G.
Tiw '69	13. India H.
Tiw '71	13. India H.
Tiw. & Moiz. '71	13. India C.
Tiw. & Nav. '67	4. Parana Basin H.
Townr. '62	General
Venk. '70	13. India B.
Venk. '72	13. India general
Venk. et. al. '67	13. India I.
Venk. & Kar '64	13. India I.
Venk. & Kar '65	13. India I.
Venk. & Kar '66a	13. India J.
Venk. Kar '66b	12. Salt Range A.
Venk. & Kar '68a	13. India I.
Venk. & Kar '68b	12. Salt Range A.
Venk. & Kar '68c	13. India I.
Venk. et al. '69	13. India B.
Virk. '37	12. Salt Range A; 19. Sydney Basin C; General.
Virk. '39	12. Salt Range A; 13. India H, I; 17. S. Australia H; General.
Virk. '46	12. Salt Range A; 13. India H, I; 17. S. Australia H; 19. Sydney Basin C; General
Utt. '70	7. Zambia D, E.
Utt. in press a	7. Zambia D.
Utt. in press b	7. Zambia D.
Ybert. & Marq. '70	4 Parana Basin I.

Chronological list of references

(253 REFERENCES)

Sew. '14
Sew. Nov. '33
Virk. '37
Virk. '39
Pant '42
Pant 43
Mehta '44
Sen '44
Dulh. '45
Virk. ('45) April '46
de Jers. Oct. '46
Dulh. '46
Ghosh et al. April '47
Ghosh & Sen July '48
Dulh. & Dulh. '49
Pant '49
Gosw. '50
Gosw. '51
Balme '52
Sur. et. al. '53
Sen. '53
Ril. '54
Sith. et al. '54
Pant Oct. '55
Sriv. ('54) Dec. '55
Balme & Henn. '55
Pot. Sept. '56
Sur. & Lele ('55) Dec. '56
Balme & Henn '56a
Balme & Henn. '56b
Guhas. '56
Balme '57
Bhatt. et. al. '57
Datta '57
Plum. '57
Pant Jan. '58a
Sur. ('57) May '58
•Balme & Playf. '58
Baner. '58
Das '58
Henn. '58
Pant '58b
Pav. '58
Lesch. May '59
Bhatt. '59
Crohn '59
Gang. '59
Pier. '59
Lak. et. al. ('58) April '60
Pot. & Sah ('58) April '60
Doub. & Rakoto. '60
Hart '60
Hoeg & Bose '60
Jek. et. al. '60
Pant & Naut. '60
Rakoto. '60
Pot. & Lele ('59) March '61
Dev. ('59) March '61
Bharad. ('60) Feb. '62
Banks Dec. '62
Hart Dec. '62
Balme '62
Schopf '62
Sriv. & Pawde '62

Thierg. & Frantz '62
Townr. '62
Hart May '63a
Crid. '63
Hart '63b
Jek. & Goub. '63
Machiav. '63
Pant & Mehra '63
Hill & Woods '63
Bharad & Tiw. ('63) May '64a
Lele ('63) May '64
Bharad. & Sal. ('63) May '64
Tiw. ('63) Nov. '64
Lele & Maithy ('63) Nov. '64
Jek. & Goub. (symp. '62) Dec. '64
Bharad. & Tiw. (symp. '63) '64b
Hart (symp. '63) '64a
Chand. et. al. (symp. '64) '64
Balme '64
•Evans '64a
•Evans '64b
•Evans '64c
Hart '64b
Schopf '64
Venk. & Kar '64
Bharad. & Sal. ('64) March '65a
Bharad. & Sal. ('64) March '65b
Lele ('64) March '65b
Goub. Oct. '65
Pant & Sriv. Oct. '65
•Pat. Oct. '65
Tiw. ('64) Oct. '65
Bharad. et. al. ('64) Oct. '65
Cousm. Nov. '65
Sal. ('64) Nov. '65
Maithy ('64) Nov. '65
Venk. & Kar ('64) Nov. '65
Chand. & Sats. '65
Ghosh '65
Hart '65a
Hart '65b
Har. & Lud. Jan. '66
Hart Jan. '66a
Maithy ('65) April '66a
Nav. ('65) April '66
Bharad. & Tiw. ('66) Sept. '66
Nav. & Tiw. ('66) Sept. '66
Venk. & Kar ('66) Sept. '66a
Venk. & Kar ('66) Sept. '66b
Bose & Kar Dec. '66
Bose & Mahesh. Dec. '66
Plum. Dec. '66
Bharad. (symp. '64) '66
Lele (symp. '64) '66
Maithy (symp. '64) '66b
Mahesh. (symp. '64) '66
Kar (symp. '64) '66
Balme & Segr. '66
•Evans '66a
•Evans '66b
•Evans '66c
•Hart '66b

Kar & Bose March '67
Bose & Kar March '67
Kar March '67
Mahesh. ('66) March '67
Banks & Naqvi June '67
Mahesh. & Kar July '67
Segr. July '67
Venk. et. al. Aug. '67
Balme & Playf. Dec. '67
Tiw. & Nav. Dec. '67
•Balme '67
•Evans '67a
•Evans '67b
Nav. & Tiw. '67
•Har. & McG. Jan. '68
Tiw. Jan. '68a
Nav. & Tiw. March '68
Bharad. & Tiw. ('67) July '68
Venk. & Kar ('67) July '68a
Bose & Mahesh. Aug. '68
Kar ('67) Sept. '68a
Venk. & Kar ('67) Sept. '68b
Kar ('67) Nov. '68b
Tiw. ('67) Nov. '68b
Venk. & Kar ('67) Nov. '68c
Maithy ('67) Nov. '68
Kar ('67) Nov. '68c
•Balme '68
Sats. et al. '68
Bharad. & Sriv. April '69a
Kar ('68) April '69a
Bharad. & Sriv. ('68) April '69b
Kar ('68) July '69b
Bharad. & Sriv. ('68) July '69c
Venk. et. al. ('68) July '69
Bharad. & Sriv. ('68) July '69d
McK. & Gut. (symp. '68) Aug. '69
Doub. (symp. '68) Aug. '69
Maithy ('68) Aug. '69a
Bharad. & Sinha ('68) Aug. '69a
Lele & Kulk. ('68) Aug. '69
Lele & Maithy ('68) Aug. '69
Sinha ('68) Aug. '69
Jard. et. al. Nov. '69
Mahesh. & Bose Dec. '69
Kar Dec. '69c
Mahesh. Dec. '69
Bandyo. (symp. '67) '69a
Hart (symp. '67) '69a
Evans (symp. '67) '69
Menend. (symp. '67) '69
Rig & Schopf (symp. '67) '69
Bharad. (symp. '67) '69
Bharad. & Sinha '69b
Hart '69b
Tiw. '69
Datta '69
Bandyo. '69
Maithy '69b
Hart '69c
•Kemp '69
Pat '69
Segr. '69
de Jers. March '70

Venk. ('69) March '70
Kar ('69) March '70a
Bharad. & Sriv. ('69) March '70
Marg. March '70
Kar ('69) Sept. '70b
Sriv. ('69) Sept. '70
Hart (symp. '67) '70a
Hart (symp. '68) '70b
And. & And. '70
Balme '70
Bharad. '70
•Burg. '70
•Helby '70
•Klasz. & Mich. (symp. '70) unpubl.
•Rakoto. '70
Segr. '70
•Utt. '70
Ybert. & Marq. '70
Saks. ('69) March '71
Nav. & Sriv. ('69) March '71
Tiw. ('69) March '71
Bharad. & Sriv. ('70) Sept. '71
Lele & Karim ('70) Sept. '71
Maithy ('70) Sept. '71
Tiw. & Moiz ('70) Sept. '71
Har. & McG. Oct. '71
Bose '71
Menend. '71
•Norv. '71
Segr. (symp. '70) Jan. '72
Bharad. (symp. '70) Jan. 72
Rakoto. (symp. '70) Jan. '72
Sinha ('70) March '72
Anand. ('70) Aug. '72a
Anand. ('70) Aug. '72b
Bharad. & Anand. ('70) Aug. '72
Lele & Chand. ('70) Aug. '72
Nav. & Sriv. ('70) Aug. '72
Venk. ('70) Aug. '72
Sarb. Nov. '72
•Falc. '72
•Glick. '72
de Jers. April '73
Rig. May '73
Lele & Chand. ('71) July '73
Bharad. & Sriv. ('71) July '73
Kar ('71) Aug. '73
Pant & Bhat. ('71) Aug. '73
Daem. & Quad. (symp. '70) '73
Daem. & Contr. (symp. '71) ?'73
•Balme '73
Falc. '73
•Kyle (pers. comm.) '73
•Sur. (symp. '73) in press
•Pier. (symp. '73) in press
•Bar. & Kyle (symp. '73) in press
•Kemp (symp. '73) in press
•Helby & McC. (symp. '73) in press
•Utt. (symp. '73) in press a
•Falc. in press a
•Falc. in press b
•Utt. in press b
•And. this paper.

• — *unpublished references.*
bracket — includes articles appearing in a single publication.

SOUTH AMERICA

1. ARGENTINA

A. SAN LUIS Pr.

(Dwyka)	MENENDEZ, C. A. (symp. '67) '69. Datos palinologicos de las floras preterciarias de la Argentina. In: *I.U.G.S. Gondw. Symp. 1, Buenos Aires.* pp. 55-69.	samples as in Menend. '71. 14 genera, 19 species. Brief rel. frequency data on genera. 1 pl. (22 figs.), no descriptions.
	MENENDEZ, C. A. '71. Estudio palinologico del Permico de Bajo de Velez, Provincia de San Luis. *Revta Inst. nac. Invest. Cienc. nat. Mus. argent. Cienc. nat. Bernardino Rivadavia Ciencias Botanicas.*, **1(9)**, 263-206.	? samples, ? Lithology. 1 surface section, Bajo de Velez. 23 genera, 31 species (3 new). Brief rel. frequency data on major taxa. 6 pl. (41 figs.), descriptions of all species.

2. BOLIVIA

A. COCHOBAMBA Pr.

Copacabana Fm. coal member (M. Ecca)	COUSMINER, H. L. Nov. '65. Permian spores from Apillapampa, Bolivia. *J. Paleont.*, **39(6)**, 1097-1111.	6 samples, plant bearing shale. 1 surface section, Capinota near Cochabamba. 27 genera, 28 species (5 new). Rel. frequency data on species. 4 pl. (69 figs.), descriptions of the new species.

3. N. BRAZIL

A. AMAZON B.

Full Permian Succession	DAEMON, R. F. & CONTREIRAS, C. J. A. (symp. '71) '73 Zoneamento palinalogico de Baciodo Amazonas. In: *Congr. Bras. Geol. 25, São Paulo.* pp. 80-88.	? samples, ? lithology. 22 boreholes, throughout basin. 13 genera, 25 species. No frequency data. No plates, no descriptions.

4. PARANA BASIN

A, B, C, D, E. (see table of localities)

Full Permian Succession	DAEMON, R. F. & QUADROS, L. P. (symp. '70) '73. Bioestratigrafia do neopaleozóico da Bacia do Paraná. In: *Congr. Bras. Geol. 24, Brasilia.* pp. 359-412.	? samples, ? lithology. 31 boreholes, ? surface locs., throughout basin. 21 genera, 40 species. No frequency data. 9 pl. (89 figs.), descriptions of ± ½ the species.

F, G. N.E. & E.C. OUTCROP

Itarare Subgrp. (Dwyka)	KEMP, E. M. (symp. '73) in press. The palynology of late Palaeozoic glacial deposits of Gondwanaland. In: *I.U.G.S. Gondw. Symp. 3, Canberra.*	10 samples, siltstone & diamictite. 7 surface localities, 3 states in S.E. Brazil. 19 genera, 23 + species (only 10 named). Brief frequency data on major taxa. 1 pl. (32 figs.), no descriptions.

H. S.E. OUTCROP

L. Perm. c.m. (M. Ecca)	TIWARI, R. S. & NAVALE, G. K. B. Dec. '67. Pollen and spore assemblage in some coals of Brazil. *Pollen Spores*, **9(3)**, 583-605.	2 samples, coal. 2 collieries, 2 coalfields. 21 genera (2 new), 35 species (12 new). % counts of genera given. 4 pl. (74 figs.), descriptions of the new forms.
	PANT, D. D. & SRIVASTAVA, G. K. Oct. '65. Some lower Gondwana miospores from Brazil. *Micropaleontology*, **11(4)**, 468-478.	samples as in Tiw. & Nav. '67. 9 genera, 14 species (6 new). Some brief frequency data 1 pl. (28 figs.), descriptions of all species.

I. URUGUAY OUTCROP

San Gregorio Fm. (Dwyka)	MACHIAVELLO '63	(see bibliography in Kemp in press.)
	BHARADWAJ, D. C. (symp. '67) '69. Lower Gondwana formations. In: *Congr. Int. Strat. Geol. Carb. 6, Sheffield.* pp. 255-274	? samples, concretions in tillite. ? localities, N. Uruguay. genera & species not given. % counts of major taxa. 2 pl. (54 figs.), no descriptions.
San Gregorio Fm. (Dwyka)	MARQUES-TOIGO, M. March '70. *Anabaculites* nov. gen., a new miospore genus from San Gregorio Formation of Uruguay. *Ameghiniana*, **7(1)**, 79-91.	? samples, phosphoritic concretions. 2 surface localities, N. Uruguay. 1 genus (new), 1 species (new). No frequency data. 1 pl. (7 figs.), description of the new species.
	YBERT, J. P. & MARQUES-TOIGO, M. '70. *Polarisaccites* nov. gen. *Pollen Spores*, **12(3)**, 469-481.	samples as in Marq. '70. 1 genus (new), 2 species (both new). No frequency data. 4 pl. (32 figs.), descriptions of the new species.

AFRICA

5. ANGOLA

A. GABON

Full Permian Succession	JARDINE, S. et al. Nov. '69. Présence de Permien au Gabon: identification stratigraphique et sedimentologique du groupe de L'Agoula. *C. R. Somm. Soc. Geol. France*, **8**, 297-298.	samples as in Klasz. & Mich. '70. 11 genera, no species. No frequency data. No plates, no descriptions.
	DE KLASZ, I & MICHOLET, J. (symp. '70) unpubl. Elements nouveaux concernant la biostratigraphie du Bassin Gabonais. In: *Colloq. Afr. Micropaleont. 4, Abidjan.* pp. 109-141.	Numerous samples, ? lithology. ? boreholes. 25 genera, no species. No frequency data. No plates, no descriptions.

6. CONGO

A, B, C, D, E, F, G. (see table of localities)

Assise houille (M. Ecca)	PIERAART, P. '59. Contribution à l'étude des spores et pollens de la flore à *Glossopteris* contenus dans les charbons de la Luena (Katanga). *Mem. Acad. r. sci. colon., Sci. nat. et med.* **8(4)**, 1-80.	? samples, coal. ? localities. **Luena region.** 11 genera, 14 species. No frequency data. 5 pl. (20 figs.), descriptions of all species.
Assise houille; Assise Walikaie (M. Ecca) (L. Ecca, l. part)	HOEG, O. A. & BOSE, M. N. '69. The *Glossopteris* flora of the Belgian Congo. *Annls. Mus. r. Congo Belge, Sci. geol.*, **32**, 1-106.	34(53) samples, shale & coal. 27 surface locs., 1 borehole, **Walikale, Lukuga, Luena & Lufupa regions.** 10 + genera, 25 species (3 new). Some brief frequency data.
Assise Walikale; Assise glaciers (L. Ecca, L. part) (Dwyka)	BOSE, M. N. & KAR, R. K. Dec. '66. Palaeozoic sporae dispersae from Congo. 1. Kindu-Kalima and Walikale regions. *Annls. Mus. r. Afr. cent., Sci. geol.*, **53**, 1-168.	46(130) samples, shale 43 orad & River cuttings, **Walikale, Kindu-Kalima & Yumbi-Lubutu regions.** Many genera (12 new) & species (many new). % counts of genera. 34 pl. (304 figs.), descriptions of all species.
Assise glaciers (Dwyka)	BOSE, M. N & MAHESHWARI, H. K. Dec. '66. Palaeozoic sporae dispersae from Congo. 2. The Epulu River (Ituri). *Annls. Mus. r. Afr. cent., Sci. geol.*, **53**, 242-249.	1 sample, plant bearing shale. 1 surface locality, **Epula River.** 13 genera, 14 species (1 new). Brief rel. frequency data. 6 pl. (16 figs.), descriptions of all species.
Assise Lukuga (L. Ecca, u. part)	KAR, R. K. & BOSE, M. N. March '67. Palaeozoic sporae dispersae from Congo. 3. Assise des Schistes Noirs de la Lukuga. *Annls. Mus. r. Afr. cent., Sci. geol.*, **54**, 1-59.	4(6) specimens, shale. 2 surface localities, 1 borehole, **Lukuga region** 40 genera (2 new), 77 species (19 new). % counts of genera. 11 pl. (138 figs.), descriptions of most species.
Assise houille (M. Ecca)	BOSE, N. N & KAR, R. K. March '67. Palaeozoic sporae dispersae from Congo. 4. On some new miospore genera. *Annls. Mus. r. Afr. cent., Sci. geol.*, **54**, 87-98.	2 samples, shale & coal 1 surface loc. 1 borehole, **Luena & Lukuga regions.** 4 genera (all new) 4 species (all new). No frequency data. 1 pl. (7 figs.), descriptions of all species.
Assise houille; Assise Lukuga (M. Ecca; L. Ecca, u. part)	BOSE, M. N & MAHESHWARI, H. K. Aug. '68. Palaeozoic sporae dispersae from Congo. 7. Coal measures near Lake Tanganyika, south of Albertville. *Annls. Mus. r. Afr. cent., Sci. geol.*, **60**, 1-116.	12(17) samples, shale & coal. 7 surface localities, **Lukuga region.** 64 genera (2 new), 132 species (23 new). % counts of genera. 21 pl. (177 figs.), descriptions of most species.
Assise houille (M. Ecca)	MAHESHWARI, H. K. & BOSE, M. N. Dec. '69. Palaeozoic sporae dispersae from Congo. 8. The Kibamba River (Lukuga Coalfield area). *Annls. Mus. r. Afr. cent. Sci. geol.*, **63**, 1-60.	3 samples, shale. 1 river cutting, **Lukuga region.** 55 genera (1 new), 107 species (13 new). % counts of genera. 9 pl. (152 figs.), descriptions of most species

Assise glaciers (Dwyka)	KAR, R. K. Dec. '69c Palaeozoic sporae dispersae from Congo. 9. Ombela and Lokandu regions (Lualaba River). *Annls. Mus. r. Afr. cent., Sci. geol.*, **63**, 83-104.	2 samples, shale. 2 surface localities, **Kindu-Kalima region.** 38 genera (1 new), 52 species (2 new). % counts of genera. 2 pl. (14 figs.), descriptions of the new species.
Assise glaciers (Dwyka)	MAHESHWARI, H. K. Dec. '69. Palaeozoic sporae dispersae from Congo. 10. Microfossils from a cliff section at the Confluence of Lufupa and Mushyashya Rivers, South Katanga. *Annls. Mus. r. Afr. cent. Sci. geol.*, **63**, 115-168.	2 samples, shale. 1 river cutting, **Lufupa region.** 50 genera (2 new), 107 species (14 new). % counts of genera. 6 pl. (79 figs.), descriptions of ± ½ the species.
Assise houille (M. Ecca)	PIERART, P. (symp. '73) in press. Some microfloral taphrocoenoses from the Lower Gondwana of Zaire. In: *I.U.G.S. Gondw. Symp. 3, Canberra*	(summary only seen).

GENERAL

General	KAR, R. K. March '67 Palaeozoic sporae dispersae from Congo. 6. On the organisation of monosaccate pollen grains. *Annls. Mus. r. Afr. cent. Ser. 8vo.*, **54**, 117-124.	The 18 genera of monosaccate pollen grains described from the Congo to date, are listed and briefly discussed.
General	BOSE, M. N. '71. Palynostratigraphy of the Lukuga Series in Congo. *Geophyt.*, **1(1)**, 16-22.	An account of the chief miospore characteristics of the 5 lithostratigraphic units within the Permian of the Congo is given.

7. ZAMBIA

A. MHUKURU Cf.

L. Perm. c.m (M. Ecca)	PANT, D. D. Jan. '58a. The structure of some leaves and fructifications of the *Glossopteris* flora of Tanganyika. *Bull. Br. Mus. nat. Hist.*, **3(4)**, 127-175.	Plant bearing shales, 6 boreholes, Mhukuru Cf. A few undehisced sporangia (pollen sacs) bearing numerous disaccate grains, & 7 seeds (possibly of the same species of parent plant) carrying similar grains at their micropylar ends are illustrated and described.
	PANT, D. D. '58b. Structure of some roots and spores from the Lower Gondwana (Permo-Carboniferous) of East Africa. *Res. J. Hindi Sci. Acad.*, **4**, 231-244.	samples as in Pant '58a. Several types of pollen grains (isolated) are illustrated and described.

B. KETEWAKA/MCHUCHUMA Cf.

L. C.M. (M. Ecca)	HART, G. F. '60. Microfloral investigation of the Lower Coal Measures (K2); Ketewaka-Mchuchuma Coalfield, Tanganyika. *Bull. geol. Surv. Tanganyika*, **30**, 1-18.	14 samples, coal & shale. 6 surface locs. (2 areas), Mchuchuma & Nyakapenda R. Valleys. 12 genera, 21 species (11 new). No frequency data. 3 pl. (44 figs.), descriptions of most species.
	HART, G. F. Dec. '62.	(see bibliography in Hart '65b).
	HART, G. F. '63b. Microflora from the Ketewaka-Mchuchuma Coalfield, Tanganyika. *Bull. geol. Surv. Tanganyika*, **36**, 1-27.	17 samples, varied lithology. ? surface locs., Mchuchuma R. Valley. 30 genera (2 new), 51 species (7 new). % counts of species. 1 pl. (18 figs.), descriptions of the new species.

B, C. (see table of localities)

L. Perm. c.m. (M. Ecca)	HART, G. F. '65a Miospore zones in Karroo sediments of Tanzania. *Palaeont. afr.*, **9**, 139-150.	**Ket.-Mch.Cf.** 28(54) samples, coal. ?surface localities, Nyakapenda R. Valley. **Song.-Kiw. Cf.** 11(14) samples, shale & coal. colliery (Ilima Colliery). 27 genera, 48 species. % counts of species per sample. No plates, no descriptions. (The results in Hart '63b are also repeated).

D, E. (see table of localities)

Full Permian Succession	UTTING, J. '70. *Karroo stratigraphy & palynology of the Upper Luangwa Valley & Lower Karroo palynology of the mid Zambezi Valley, Zambia.* Sheffield Univ. (unpubl. Ph.D. Thesis).	(species list only seen)
Luwumbu Coal Fm. (Dwyka & M. Ecca)	UTTING, J. (symp. '73) in press a Pollen and spores from the Luwumbu Coal Formation (Lower Karroo) of the North Luangwa Valley, Zambia. In: *I.U.G.S. Gondw. Symp. 3, Canberra.*	(summary only seen)
Full Permian Succession	UTTING, J. in press b Karroo stratigraphy of the northern part of the Luangwa Valley. *Mem. geol. Surv. Zambia*, **4**.	(Not seen)

F. M. ZAMBEZI V. (RHODESIA)

Full Permian Succession	FALCON, R. M. S. '72. *Preliminary palynology of the Mid-Zambezi Basin, Rhodesia.* Univ. Witwatersrand (unpubl. M.Sc. Thesis).	48(105) samples, varied lithology. 1 borehole (Matabola Flats), Mid-Zambezi Val 55 genera, 100 species (4 new). Rel. frequency data for species. 16 pl (286 figs.), descriptions of all species.
	FALCON, R. M. S. '73. Palynology of the Middle-Zambezi Basin. In: *Bond, G. The palaeontology of Rhodesia* Rhod geol. Surv. Bull., **70**, pp. 43-71.	samples as in Falc. '72. 55 genera, no species. Frequency data on major taxa. 4 pl. (51 figs.), no descriptions.
	FALCON, R. M. S. in press. Statistical application to the palynological zones of the Matabola Flats borehole, Rhodesia. To be publ. in *Palaeont. afr.*	samples as in Falc. '72. 55 genera, 100 species. No frequency data. No plates, no descriptions.
	FALCON, R. M. S. in preparation Lower Karroo palynology & assemblage zones of the Matabola Flats borehole, Rhodesia. To be publ. in *Palaeont. afr.*	samples as in Falc. '72. 55 genera, 100 species (4 new). Brief rel. frequency data. ?no of plates & figs., descriptions of all species.

8. S. W. AFRICA

A. W. KALAHARI B.

Nossob Sdst. (L. Ecca, L.part)	LESCHIK, G. May '59. Sporen aus den "Karru-Sandsteinen" von Norronaub (Südwest-Afrika). *Senckenberg. leth.*, **40(1-2)**, 51-95.	? samples, coaly lense (plant bearing). 1 surface locality, near Norronaub. 18 genera (3 new), 27 species (18 new). % counts of species. 5 pl. (41 figs.), descriptions of all species.

9. KARROO BASIN

A, B, C, D, E, F, G, H, I, J, K. (see table of localities)

M. Ecca	RILLETT, M. H. P. '54. Plant microfossils from the coal seams near Dannhauser, Natal. *Trans. geol. Soc. S. Afr.*, **57**, 27-37.	6 specimens, coal (2 seams). 1 colliery, Dannhauser district. 5 genera, 12 species (no names given). No frequency data. 1 pl. (12 figs.), descriptions of all species
M. Ecca	PLUMSTEAD, E. P. '57.	(see bibliography in Falc. '72).
L. Ecca, L.part	HART, G. F. May '63a. A probable pre-*Glossopteris* micro-floral assemblage from Lower Karroo sediments. *S. Afr. J. Sci.*, **59(5)**, 135-146.	5(7) samples, carb. shale. 1 bh. (Salisbury), 10m W. of Viljoens-Kroon. 27 genera (1 new), 47 species (11 new). % counts of species. 1 pl. (15 figs.), descriptions of new species.
L. Ecca	HART, G. F. '64b. *Chomotriletes* from the Lower Permian of South Africa. *Ann. geol. Surv. S. Afr.*, **3**, 149-157.	2 samples, argillaceous rock. 1 surface locality, Pienaar's Pot-hole. 11 genera, 17 species (1 new). % counts of species. 1 pl. (15 figs.), description of new specie.
Tapinocephalus equiv.	HART, G F. Jan. '66a. *Vittatina africana*, a new miospore from the Lower Permian of South Africa. *Micropaleontology*, **12(1)**, 37-42.	1 sample, ? lithology. 1 borehole (Heilbron 401), Heilbron district 21 genera, 36 species (1 new). % counts of species. 1 pl. (7 figs.), description of new specie.
? age	PLUMSTEAD, E. P. Dec. '66.	(see bibliography in Falc. '72).
Full Permian Succession	HART, G. F. '66b. *Lower Karroo biostratigraphy of parts of Southern Africa.* Univ. Witwatersrand, geol. (unpubl. report).	601(1808) samples, varied lithology. 51 prod. locs. (49 bhs, 1 col., 1 surface). 62 genera (2 new), 160 species (64 new). % counts of species per sample. No plates, no descriptions. (Material primarily from N. Karroo B. but incls: 1 surface loc., Springbok Flats. 1 borehole, Soutpansberg area. 1 borehole, Waterberg Coalfield. 6 boreholes, E. Bechuanaland. a repeat of Harts Zambian material.)

Tapinocephalus equiv.	HART, G. F. '69b. A variation study of *Lueckisporites nyakapendensis.* In: *J. Sen. Memorial Volume* pp. 17-31.	1 sample, ? lithology. 1 borehole (Heilbron 401), Heilbron district. 1 genus, 1 specie. % count of specie. 1 pl. (21 figs.), description of the specie.
M. Ecca	HART, G. F. '69c. Lower Karroo (Permian) Acanthomorphitae acritarchs from South Africa. *Palaeont. afr.*, **12**, 53-73.	B samples, ? lithology. 6 boreholes, N. Karroo Basin. 1 genus, 2 species (no specific names given). % count of genus. 2 pl. (12 figs.), descriptions of the 2 species.
Full Permian Succession	ANDERSON, J. M. This paper. *Biostratigraphic palynology of the Permian sediments of the northern part of the Karroo Basin, South Africa.*	53 assemblages, grey siltstone & carb. shale. 12 boreholes, 4 surface localities. 33 genera (4 new), 133 species (48 new). % counts of species per assemblage. 1BB pl. (5494 figs.), descriptions of all species. (Material primarily from N. Karroo B. but incls: 1 surface loc., Springbok Flats. 1 surface loc., S.C. Karroo Basin.

GENERAL

Full Permian Succession	HART, G. F. (symp. '67) '69a. Micropalaeontology of the Karroo deposits in South and Central Africa. In: *I.U.G.S. Gondw. Symp. 1 (Reviews), Buenos Aires.* pp. 161-172.	The Permian succession of the Karroo Basin is divided into 4 palynologic biozones. These zones are elucidated in terms of constituent genera, species & relative frequency data.

10. MOCAMBIQUE

(No literature to date)

11. MADAGASCAR

A, B. N. & S. MORONDAVA B.

L. Sakamena 'Grp.' (Daptocephalus Z.)	JEKHOWSKY, SAH & LETULLIER '60.	(see bibliography in Hart '70a)
	JEKHOWSKY & GOUBIN '63.	
	JEKHOWSKY, B. & GOUBIN, N (symp. '62) Dec. '64. Subsurface palynology in Madagascar: A Stratigraphic sketch of the Permian, Triassic and Jurassic of the Morondava Basin. In: *Palynology in oil exploration.* pp. 116-130.	? samples, ? lithology. ± 12 boreholes, N.&S. Morondava Basin. 6 genera, no species. % counts of genera. 1 pl. (7 figs.), no descriptions.
	GOUBIN, N. Oct. '65. Description et répartition des principaux pollenites Permiens, Triassiques et Jurassiques des sondages du Bassin de Morondava (Madagascar). *Revue Inst. fr. Pétrole*, **20(10)**, 1415-1461.	samples as in Jek. & Goub. '64. 6 genera (1 new), 8 species (5 new). % counts of genera. 6 pl. (16 figs.), descriptions of all species.

C. SAKOA B.

Sakoa 'Grp.' c. m. (M. Ecca)	DOUBINGER & RAKOTOARIVELO '60.	(see bibliography in Hart '70a)
	RAKOTOARIVELO, H. J '60. Etude palynologique de quelques echantillons de houille du Bassin de la Sakoa (Madagascar). *Serv. Geol, Tananarive,* 1-49.	(not seen)
	RAKOTOARIVELO, H. J. '70. *Palynostratigraphie comparee du Bassin Houiller Gondwanien de la Sakoa – Sakamena, Madagascar.* Univ. Paris (unpubl. D.Sc. Thesis).	110 samples, mostly coal. 11 boreholes, Sakoa Basin. 64 genera, 116 species. % counts of species. 23 pl. (1B1 figs.), descriptions of all species.
	RAKOTOARIVELO, H. J. (symp. '70) Jan. '72. Palynostratigraphic review of the coal basin of the Sakoa-Sakamena (Madagascar). In: *I.U.G.S. Gondw. Symp. 2, South Africa.* pp. 537-540.	samples as in Rakoto. '70. 64 genera, no species. % counts of main taxa. No plates, no descriptions.

INDIA

12. SALT RANGE

A. SALT RANGE

1½ -25 ft. above Tachir Boulder Bed (L. Ecca)	VIRKKI, C. '37. On the occurrence of winged spores in the Lower Gondwana rocks of India and Australia. *Proc. Indian Acad. Sci. Section B*, **6**, 428-431.	? samples, shale (some plant bearing) 1 surface section, Kathwai. 1 genus, 1 specie. (no names given). No frequency data. 1 pl. (2 figs.), very breif description of specie.
	VIRKKI, C. '39. On the occurrence of similar spores in a Lower Gondwana glacial tillite from Australia and in Lower Gondwana shales in India. *Proc. Indian Acad. Sci. Section B*, **9**, 7-12.	samples as in Virk. '37. 1 genus, 1 specie (no name given). No frequency data. 1 pl. (4 figs.), very brief description of specie.
Just below M. Productus Limestone; 1½ -25 ft. above Talchir Boulder (U. Ecca, l.part) (L. Ecca)	VIRKKI, C. '45) April '46. Spores from the Lower Gondwanas of India and Australia. *Proc. Indian Acad. Sci.* **15(4, 5)**, 93-176.	? samples, ? lithology. 3 surface locs.; Kathwai, Warcha, Jhallewali Many types of miospore noted (majority unnamed). No frequency data. 7 pl. (102 figs.), descriptions of all species.
25 ft. above Talchir Boulder Bed (L. Ecca)	VENKATACHALA, B. S. & KAR, R. K. ('66) Sept. '66b. *Corisaccites* gen. nov., a new saccate pollen genus from the Permian of Salt Range, West Pakistan. *Palaeobotanist*, **15(1, 2)**, 107-109.	samples as in Venk. & Kar '68b. 1 genus (new), 2 species (both new). No frequency data. 1 pl. (11 figs.), descriptions of new species.
	VENKATACHALA, B. S. & KAR, R. K. ('67) Sept. '6Bb. Palynology of the Kathwai Shales, Salt Range, West Pakistan. 1 — Shales 25 ft. above the Talchir Boulder Bed. *Palaeobotanist*, **16(2)**, 156-166.	? samples, shale. 1 surface locality, Kathwai. 28 genera (2 new), 33 species (16 new). No frequency data. 6 pl. (72 figs.), descriptions of new species.
Amb. to Chhidru Fms. (U. Ecca, l. part to Daptocephalus Z.)	BALME, B. E. '70. Palynology of the Permian & Triassic strata in the Salt Range and Surghar Range, West Pakistan. In: *Stratigraphic boundary problems: Permian and Triassic of West Pakistan.* Univ. Kans. Dept. Geol. Sp. Publ., **4**, 305-453.	27 samples, varied lithology. 7 surface sections, Salt Range. 47 genera (1 new), 57 species (21 new). Rel. frequency data on species. Many pls. & figs., descriptions of all species.
Talchir Fm. (Dwyka)	KEMP, E. M. (symp. '73) in press. The palynology of late Palaeozoic glacial deposits of Gondwanaland In: *I.U.G.S. Gondw. Symp. 3, Canberra.*	2 samples, diamictite. 1 surface section, Zaluch Nala. 12 genera, 12 species Rel. frequency data on major taxa. 1 pl. (15 figs.), no descriptions.

B. NAINI TAL

Lower Krol series (? age)	SITHOLEY, R. V., SAH, S.C.D. & DUBE, S.N., '54 Plant microfissils from a carbonaceous shale (Krols) near Naini Tal. *J.scient. ind. Res. Section B. Physical sciences*, **13B(6)**. 450-451.	? samples, shale. 1 surface locality, 11 m. from Kathgodam. 5 types of miospore (no names given). No frequency data. 1 pl. (4 figs.), no descriptions.
	LAKHANPUL, R. N., SAH, S. C. D. & DUBE, S. N ('5B) April '60. Further observations on plant microfossils from a carbonaceous shale (Krols) near Naini Tal, with a discussion on the age of the beds. *Palaeobotanist*, **7(2)**, 111-120.	samples as in Sit. et. al. '54. 11 genera, 1B species (9 new). No frequency data. 2 pl. (29 figs.), descriptions of all species.

13. INDIA

A. MALABAR COAST (reworked Permian)

(? age)	POTONIE R. & SAH, S. C. D. ('58) April '60 Sporae dispersae of the lignites from Cannanore Beach on the Malabar coast of India. *Palaeobotanist*, **7(2)**, 121-134.	3 samples, liguite (late Tertiary). 1 sea cliff locality, Cannanore beach. Several genera & species are described & presumed to be all Late Tertiary. 4 pl. (39 figs. 12 of which are most likely of Perm. miospores).

B. KUTCH (reworked Permian)

(? age)	VENKATACHALA, B. S., KAR, R. K. & RAZA, S. ('68) July '69. Palynology of the Mesozoic sediments of Kutch, W. India – 5. Spores & pollen from Katrol exposures near Bhuj, Kutch district, Gujarat State. *Paleaobotanist*, **27(2)**, 184-207.	81(203) samples, varied lithology (U. Jurassic). 9 surface sections, Kutch district. 36 genera & 108 species are recorded (U. Jurassic). 2 pl. (51 figs. – 1 of which is most likely of a Perm. miospore).
	VENKATACHALA, B. S. ('69) March '70. Palynology of the Mesozoic sediments of Kutch, W. India. 7. Reworked Permian pollen from the Upper Jurassic sediments – a discussion. *Palaeobotanist*, **18(1)**, 45-49.	samples as in Venk. et al. '69. Many undoubted Perm. miospores are recorded as occuring commonly with typical U. Jurassic forms. 1 pl. (11 figs. – All of Perm. miospores).

C. GODAVARI V.

1. GODAVARI COALFIELDS

Barakar Fm. (M. Ecca)	TIWARI, R. S. & MOIZ, A. A. ('70) Sept. '71. Palynological study of lower Gondwana (Permian) coals from Godavari Basin, India. 1 – On some new miospore genera. *Palaeobotanist*, **19(1)**, 95-104.	? samples, coal (major coal seams). ? localities. 5 genera (all new), 10 species (all new). No frequency data. 2 pl. (44 figs.), descriptions of all species.
(? age)	THIERGART, F. & FRANTZ, U. '62. Pollen und sporen einer Kohlenprore von Kothagundem, Indien. *Dent. Bot.*, **75(3)**, 71-77.	(Not seen)

D, E. WARDHA V. & SATPURA REGION

D1, E1, 2. WARDHA, PATHAKHERA & PENCH-KANHAN COALFIELDS

Barakar Fm. (M. Ecca)	ANAND-PRAKESH ('70) Aug. '72a. A new monosaccate pollen from the Barakar coals of India. *Palaeobotanist*, **19(3)**, 203-205.	samples as in Anand. '72b. 1 genus (new), 2 species (1 new). No frequency data. 1 pl. (8 figs.), description of new specie.
	ANAND-PRAKESH ('70) Aug. '72b. Sporae dispersae in the coals of Pench-Kanhan & Pathakhera Coalfield (M.P.) India. *Palaeobotanist*, **19(3)**, 206-210.	? samples, coal. ? boreholes & collieries. 37 genera, 61 species (5 new). No frequency data. 2 pl. (20 figs.), descriptions of new species.

3. NARSINGHPUR DISTRICT (reworked Permian)

(? age)	DEV. ('59) March '61 The fossil flora of the Jabalpur Series 3. Spores & pollen grains. *Palaeobotanist*, **8(1, 2)**, 43-56.	? samples, shale (Jurassic). 1 surface loc. N.E. of Sehoro on Sher R. 29 genera & 45 species are described & presumed to be all Jurassic. 8 pl. (69 figs. – 12 of which are most likely of Perm. miospores).

F. S.E. MAHANADI V.

1. TALCHER COALFIELD

Barakar Fm. (M. Ecca)	DAS, D. K.	(see bibliography in Tiw. '64)
	NAVALE, G. K. B. (65) April '66. Petrographic & sporological studies of some coals from Talcher Coalfield, Orissa, India. *Palaeobotanist*, **14(1, 2, 3)**, 61-69.	? samples, coal. 2 collieries, Nandira & S. Balanda Collieries. 19 genera, no species. No frequency data. 2 pl. (24 figs.), brief descriptions of each genus.
	NAVALE, G. K. B. & TIWARI, R. S. (66) Sept. ''66. A preliminary sporological analysis of some coals from Talcher Coalfield, India *Palaeobotanist*, **15(1, 2)**, 47-51.	samples as in Nav. '66. 33 genera, no species. % counts of genera 2 pl. (24 figs.), no descriptions.
	BHARADWAJ, D. C. & SRIVASTAVA, S. C. (68) July '69c Palynological correlation of coal seams in Talcher Coalfield, Orissa, India. *Palaeobotanist*, **17(2)**, 152-156.	19 samples, coal. 10 boreholes, throughout coalfield. 39 genera, no species. % counts of genera. No plates, no descriptions.
	BHARADWAJ, D. C. & SRIVASTAVA, S. C. (68) July 69d	(see India, general).
	SRIVASTAVA, S. C. (1969) Sept. 1970. Microfloral investigations in same coals of Talcher Coalfield (Orissa), India. *Palaeobotanist*, **18(2)**, 154-166.	39 samples, coal. 10 boreholes, 4 collieries, 1 surface loc., throughout coalfield. 36 genera, 71 species (11 new). No frequency data. 2 pl. (23 figs.), descriptions of new species.
	NAVALE, G. K. B. & SRIVASTAVA, S. C. (1969) Mar. '71. Petro-palynological study of the coals exposed near Gopalprasad of Talcher Coalfield (Orissa), India. *Palaeobotanist*, **18(3)**, 258-263.	1 sample, coal (Gopalprasad seam, 23 ft.). 1 surface locality, near Gopalprasad village. 20 genera, no species. % counts of genera No plates, no descriptions.

G. N.W. MAHANADI V.

1. IB-RIVER (RAMPUR-HINGIR) COALFIELD

Barakar Fm. (M. Ecca)	TIWARI, R. S. (67) Nov. '68b Palynological investigations of some coal seams in the Ib-River Coalfield (Orissa), India. *Palaeobotanist*, **16(3)**, 222-242.	4 composite samples, coal. 4 collieries (2 seams), near Brijraj Nagar. 34 genera (2 new), 51 species (15 new). Some brief data on rel. frequency. 8 pl. (94 figs.) descriptions of new forms.
	NAVALE, G. K. B. & TIWARI, R. S. March '68. Palynological correlation of coal seams, their nature and formation in Rampur Coalfield, Lower Gondwana (India). *Rev. Palaeobot. & Palynol.*, **6(2)**, 155-169.	samples as in Tiw. '68. 34 genera (no species) listed. % counts of genera. 1 pl. (15 figs.), no descriptions.

2. KORBA COALFIELD

	BHARADWAJ, D. C. & TIWARI, R. S. (63) May '64a	(see India, general)
	TIWARI, R. S. ('63) Nov. '64.	
	TIWARI, R. S. (64) Oct. '65.	
Barakar Fm. (M. Ecca)	BHARADWAJ, D. C. & TIWARI, R. S. (symp. '63) '64b. The correlation of coalseams in Korba coalfield, Lower Gondwanas, India. In: *Congr. Int. Strat. Geol. Carb. 5, Paris.* pp. 1131-1143	35 samples, coal (5 seams). 26 boreholes, 3 sectors of the coalfield. 41 genera, no species. % counts of genera 2 pl. (31 figs.), no descriptions.
	TIWARI, R. S. Jan. '68a. *Hennellysporites*, a new miospore genus from Lower Gondwana horizons. *Curr. Sci.*, **37(2)**, 52-53.	? samples as in Bharad & Tiw. '64b. 1 genus (new), 1 species (new). No frequency data. No plates, description of the new specie.
Talchir to Karharbari Fm. (Dwyka to L. Ecca)	BHARADWAJ, D. C. & SRIVASTAVA, S. C. ('71) July '73 Subsurface palynological succession in Korba Coalfield, M.P., India. *Palaeobotanist*, **20(2)**, 137-151.	37 (79) samples, varied lithology. 1 borehole (NCK8-19). 50 genera, no species. % counts of genera No plates, no descriptions.

3. BISRAMPUR COALFIELD

Barakar Fm (M. Ecca)	BHARADWAJ, D. C. & SRIVASTAVA, S. C. (68) July 69d.	(see India, general)
	BHARADWAJ, D. C. & SRIVASTAVA S. C. (69) Mar. '70. Sporological correlation of coal seams in Bisrampur Coalfield, M.P., India. *Palaeobotanist*, **18(1)**, 87-94.	21 samples, composite coals. 17 boreholes, throughout coalfield. 27 genera, no species. % counts of genera. No plates, no descriptions.

H. SON V.

1. CHIRIMIRI COALFIELD

Barakar Fm. (M. Ecca)	GANGULY, '59.	(see bibliography in Tiw. '64).
	BHARADWAJ, D. C. & SRIVASTAVA, S.C. (68) April '69b. Correlation of coal seams in Chirimiri Coalfield, M.P., on the basis of sporae dispersae. *Palaeobotanist*, **17(1)**, 36-42.	15 samples, coal. 8 collieries, throughout Coalfield. 36 genera, no species. % counts of genera. No plates, no descriptions.
	BHARADWAJ, D. C. & SRIVASTAVA, S. C. (68) July 69d.	(see India, general)

2. JHAGRAKHAND COALFIELD

Talchir & Barakar Fms. (Dwyka & M. Ecca)	DATTA, A. K. '57. Notes on the palaeontology of the sedimentary rocks in the Jhagrakhand area, Madhya Pradesh. *Q. Jl. geol. Min. metall. Soc. India*, **29**, 1-18.	(Not seen)

3. MANENDRAGARH DISTRICT

L. Talchir Fm. (Dwyka)	LELE, K. M. & CHANDRA, A. ('70) Aug. '72.	(see India, general)

4. SOHAGPUR COALFIELD

Barakar Fm. (M. Ecca)	NAVALE, G. K. B. & TIWARI, R. S. '67. Petro-palynological study of Churcha seam, Sohagpur Coalfield (M.P.), India. *J. geol. Soc. India*, **8**, 68-70.	1 sample coal (Churcha seam). 1 colliery (Churcha Colliery) 36 genera, no species. % counts of genera. 3 pl. (32 figs.), no descriptions.
	BHARADWAJ, D. C. & SRIVASTAVA, S. C. (68) July 69d.	(see India, general)
L. Karharbari to U. Barakar Fm. (L. Ecca to M. Ecca)	BHARADWAJ, D. C. & SRIVASTAVA, S. C. (70) Sept. '71. Sporological correlation of coal seams in some blocks of Sohagpur Coalfield, M.P., India. *Palaeobotanist*, **19(1)** 1-28.	53 samples, coals. 33 boreholes, throughout coalfield. 26 genera, no species. % counts of genera. No plates, no descriptions.

5. JOHILLA COALFIELD (S. REWA BASIN)

Karharbari Fm (L. Ecca)	VIRKKI, C. '39 On the occurrence of similar spores in a Lower Gondwana glacial tillite from Australia and in Lower Gondwana shales in India. *Proc. Indian Acad. Sci. Section B*, **9**, 7-12.	Samples as in Virk. '46. 1 miospore type (no name). No frequency data. No plates, no descriptions.
	VIRKKI, C. ('45) April '46. Spores from the Lower Gondwanas of India and Australia. *Proc. Indian Acad. Sci.* **15(4,5)**, 93-176.	1 sample, plant bearing carb. shale. 1 surface loc., Ganjra Nalla plant loc. 34 miospore types (majority unnamed). No frequency data. 4 pl. (49 figs.), brief descriptions of all species.
	LELE, K. M. & MAITHY, P. K. ('68) Aug. '69. Miospore assemblage of The Ganjra Nalla Beds, South Rewa Gondwana Basin, with some remarks on the age of the beds. *Palaeobotanist*, **17(3)**, 298-308.	? samples, plant bearing carb. shale. 1 surface section, Ganjra Nalla plant locality. 23 genera (4 new), 42 species (12 new). No frequency data. 3 pl. (34 figs.). descriptions of new species.
	SAKSENA, S. ('69) March '71. On fossil flora of Ganjra Nalla beds: Part II – Microflora (A) Dispersed spores and pollen grains. *Palaeobotanist*, **18(3)** 237-257.	40 + samples, plant bearing carb. shale. 1 surface locality, Ganjra Nalla plant locality. 19 genera, 66 species (15 new). Brief rel. frequency data. 7 pl. (86 figs.), descriptions of all species.
Talchir Fm. (Dwyka)	POTONIE, R and LELE, K. M. ('59) March '61. Studies in the Talchir flora of India – I. sporae dispersae from the Talchir beds of South Rewa Gondwana Basin. *Palaeobotanist*, **8(1,2)**, 22-37.	? samples, plant bearing shale. 1 surface section, Goraia plant loc. (Johilla R.). 13 genera, 25 + species (2 new). No frequency data. 3 pl. (97 figs.), descriptions of all species.
	LELE, K. M. ('63) May '64. Studies in the Talchir flora of India 2. Resolution of the spore genus *Nuskoisporites* Pot. & Kl. *Palaeobotanist*, **12(2)**, 147-168.	samples as in Pot. & Lele '61. 2 genera (both new), 5 species (all new). No frequency data. 2 pl. (20 figs.), descriptions of all species.
	LELE, K. M. ('64) March '65. Studies in the Talchir flora of India: 3. Stellapollenites: a new monosaccate pollen genus from the South Rewa Gondwana Basin. *Palaeobotanist*, **13(1)**, 109-113.	samples as in Pot. & Lele '61. 1 genus (new), 1 specie (new). No frequency data. 1 pl. (4 figs.), description of the new specie.
	LELE, K. M. (symp. '64) '66.	(see India, general).
	LELE, K. M. & CHANDRA, A. ('71) July '73. Studies in the Talchir flora of India: 8. Miospores from the Talchir boulder bed and overlying needle shales in the Johilla Coalfield (M.P., India). *Palaeobotanist*, **20(1)**, 39-47.	2(4) samples, needle shales & boulder beds. 1 stream section, ¾ m N.W. of Mangthar. 19 genera, 31 species (8 new). % counts of genera. 2 pl. (15 figs.), descriptions of new species.
(? age)	MEHTA, K. R. '44. GOSWAMI, S. K. '50. GOSWAMI, S. K. '51.	(see bibliography in Hart '65b).

6. UMARIA COALFIELD

Karharbari Fm. (L. Ecca)	MAITHY, P. K. ('65) April '66a. Studies in the Glossopteris flora of India: 33. Fossil plants & miospores from the coal-bearing beds of the Umaria Coalfield with some remarks on the age of the beds. *Palaeobotanist*, **14(1,2,3)**, 52-60.	? samples, plant bearing shale. Shale dumps of the new Umaria Colliery. 15 genera, 18 species. Rel. frequency data of species. 4 pl. (22 figs.), brief descriptions of all species.
	MAITHY, P. K. ('67) Nov. '68. Studies in the Glossopteris flora of India: 37. Further contribution to the miospore assemblage of the coal-bearing beds of the Umaria Coalfield, Madhya Pradesh. *Palaeobotanist*, **16(3)**, 270-272.	Additional samples, plant bearing shale. Shale dumps of the new Umaria Colliery. 12 genera & 15 species (additional to those in Maithy '66a. No frequency data. 1 pl. (19 figs.), no descriptions.
U. Talchir to Karharbari Fm. (Dwyka to L. Ecca)	LELE, K. M. & CHANDRA, A. ('70) Aug. '72.	(see India, general).

7. NIDPUR VILLAGE

Panchet Fm. (Lystrosaurus Zone)	CHANDRA, A. & SATSANGI, P. P. '65.	(See bibliography in Bharad. & Sriv. '69a).
	BHARADWAJ, D. C. & SRIVASTAVA, S. C. April '69. A Triassic mioflora from India. *Palaeontographica Abt. B.*, **125(4-6)**, 119-49.	? samples, plant bearing carb. shale (6" horizon) 1 surface locality, near Nidpur Village. 22 genera (4 new), 41 species (18 new). % counts of genera. 6 pl. (125 figs.), descriptions of new species.

8. SINGRAULI COALFIELD

U. Barakar Fm. (M. Ecca)	BHARADWAJ, D. C. & SINHA, V. ('68) Aug. '69a. Sporological succession & age of Jhingurdah Seam, Singrauli Coalfield, M.P., India. *Palaeobotanist*, **17(3)**, 275-287.	126 samples, coal (165m thick Jhingurdah seam) 1 borehole, Waidhan area of Sidhi District. 49 genera, 110 species. % counts of genera. No plates, no descriptions.
	SINHA, V. ('68) Aug '69. Some Acritarchs & other microfossils from Barakar Stage of Lower Gondwanas, India. *Palaeobotanist*, **17(3)**, 326-331.	samples as in Bharad. & Sinha '69a. 9 genera (1 new), 15 species (7 new). No frequency data. 1 pl. (9 figs.), descriptions of all species.
	BHARADWAJ, D. C. & SINHA, V. '69b. Some new miospores from Lower Gondwana coals. In: *J. Sen. Memorial Volume*. pp. 7-16.	samples as in Bharad. & Sinha '69a. 3 genera (all new), 4 species (all new). No frequency data. 2 pl. (24 figs.) descriptions of all species.
	SINHA, V. ('70) March '72. Sporae dispersae from Jhingurdah seam, Singrauli Coalfield (M.P.), India. *Palaeobotanist*, **19(2)**, 175-201.	samples as in Bharad. & Sinha '69a. 49 genera, 110 species (35 new). No frequency data. 8 pl. (124 figs.), descriptions of new species.
	TIWARI, R. S. '69. Sporological succession in Purewa Seam, Singrauli Coalfield (M.P.). In: *J. Sen. Memorial Volume*. pp. 93-100.	28 samples, coal & shale (Purewa Seam). 1 borehole (NCSM-3), Moher block. 42 genera, no species. % counts of genera. No plates, no descriptions.
	TIWARI, R. S. ('69) March '71. Sporological succession in Kota & Turra seams, Singrauli Coalfield (M.P.) India. *Palaeobotanist*, **18(3)**, 264-269.	4 samples, coal (Turra & Kota seams) 2 boreholes, Singrauli & Moher Blocks. 32 genera, no species. % counts of genera. No plates, no descriptions.
Talchir Fm. (Dwyka)	LELE, K. M. (symp. '64) '66.	(see India, general)

I. W. DAMODAR V.

1. DALTONGANJ COALFIELD

Karharbari Fm. (L. Ecca)	MAITHY, P. K. ('68) Aug. '69a. Palaeobotany & stratigraphy of the coal-bearing beds of the Daltonganj Coalfield, Bihar. *Palaeobotanist*, **17(3)**, 265-274.	? samples, plant bearing shale. 3 surface localities & 1 coalmine. 29 genera, 51 species (6 new). No frequency data. 1 pl. (10 figs.), descriptions of new species.
(? age)	VIRKKI, C. '39. On the occurrence of similar spores in a Lower Gondwana glacial tillite from Australia and in Lower Gondwana shales in India. *Proc. Indian Acad. Sci. Section B.*, **9**, 7-12.	samples as in Virk. '46. 1 miospore type (unnamed). No frequency data. 1 pl. (2 figs.), very brief description of the form.
	VIRKKI, C. ('45) April '46. Spores from the Lower Gondwanas of India and Australia. *Proc. Indian Acad. Sci.*, **15(4, 5)**, 93-176.	1 sample, plant bearing shale. ? locality. 14 miospore types (majority unnamed). No frequency data. 1 pl. (18 figs.) brief descriptions of all species.

2. AURANGA COALFIELD

Barakar Fm. (M. Ecca)	MAITHY, P. K. ('70) Sept. '71. Fossil flora of the Barakar Stage in Auranga Coalfield. *Palaeobotanist*, **19(1)**, 70-75.	? samples, varied lithology. 3 surface localities. 33 genera, 54 species (1 new). % counts of genera. 1 pl. (2 figs.), description of new specie.
(? age)	BHATTACHARYA, B. '59.	(see bibliography in Maithy '71)

3. SOUTH KARANPURA COALFIELD

Barakar Fm. (M. Ecca)	BHARADWAJ, D. C. & TIWARI, R. S. ('67) July '68. Sporological correlation of coal seams in Saunda & Gidi areas of South Karanpura Coalfield, Bihar, India. *Palaeobotanist*, **16(1)**, 38-90.	67 samples, coal. 6 boreholes, Saunda & Gidi areas. 43 genera, no species. % counts of genera. No plates, no descriptions.
	BANDYOPADHAY, N. N. (symp. '67) '69a.	(see India. general)
L. Karharbari Fm. (L. Ecca)	LELE, K. M. & KULKARNI, S. ('68) Aug. '69. Two miospore asemblages from the Argada sector, South Karanpura Coalfield, Bihar, with remarks on their probable age. *Palaeobotanist*, **17(3)**, 288-294.	? samples, shale (assoc. with Argada 'S' seam). 2 surface localities (? colliery), Argada sector. 25 genera, 41 species (3 new). % counts of genera. 2 pl. (21 figs.), descriptions of 17 species.

L. Karharbari Fm. (L. Ecca)	BHARADWAJ, D. C. & ANAND-PRAKESH ('70) Aug. '72. On the palynostratigraphy of Argada 'S' seam in South Karanpura Coalfield, Bihar. *Palaeobotanist*, **19(3)**, 211-213.	? samples, coal (Argada 'S' seam). ? localities, Argada sector. 22 genera, no species. % counts of genera. No plates, no descriptions.
(? age)	BHATTACHARYA, D. RAYCHOWDHURY, T. & DATTA, K. '57.	(see India, general)

4. NORTH KARANPURA COALFIELD

Raniganj Fm. (Daptacephalus (Zone)	KAR, R. K. ('67) Nov. '68c. Palynology of the N. Karanpura Basin, Bihar, India. — 3. Raniganj exposure near Langatoo, Hazaribagh District. *Palaeobotanist*, **16(3)**, 273-282	17(22) samples, varied lithology. 1 surface locality, near Lungatoo. 34 genera, 47 species (2 new). % counts of genera. 1 pl. (21 figs.), descriptions of new species.
	KAR, R. K. ('68) July '69b. Palynology of the N. Karanpura Basin, Bihar, India. — 5. Palynological assemblage of the bore-core No. K2, Raniganj State (Upper Permian). *Palaeobotanist*, **17(2)**, 101-120	19(31) samples, varied lithology. 1 borehole (K2), Ranihanj-Kavendai area. 58 genera (8 new), 12 species (all new). % counts of genera. 1 pl. (20 figs.), descriptions of new species.
Barakar Fm. to Barren M. (M. Ecca to U. Ecca)	KAR. R. K. ('68) April '69a. Palynology of the N. Karanpura Basin, Bihar, India. — 4. Subsurface palynology of the borehole No. K5. *Palaeobotanist*, **17(1)**, 9-18.	22(42) samples; varied lithology. 1 borehole (K5) Baral-Raniganj-Kevendai area. Barren M.: 51 genera (2 new), 67 species (2 new). Barakar Stage: 34 genera, 39 species. % counts of genera. 1 pl. (13 figs.), descriptions of new species.
Barakar Fm. (M. Ecca)	BANERJEE, R. '58.	(see bibliography in Tiw. '64).
	VENKATACHALA, B. S. & KAR, R. K. '64. *Schizopollis* Venkatachala & Kar, a new pollen genus from the Permian of N. Karanpura Coalfield, Bihar, India. *Grana palynol.*, **5(3)**, 413-424.	? samples, carb shale. 1 outcrop locality, near Badam village. 1 genus (new), 4 species (new). No frequency data. 3 pl. (18 figs.), descriptions of new species.
	VENKATACHALA, B. S. & KAR, R. K. ('64) Nov. '65. Two new trilete spore genera from the Permian of India. *Palaeobotanist*, **13(3)**, 337-340.	samples as in Venk. & Kar. '64. 2 genera (both new), 4 species (all new) No frequency data. 1 pl. (15 figs.), descriptions of new species.
	VENKATACHALA, B. S., GOUBIN, N. & KAR, R. K. Aug. '67 Morphological study of *Guttulapollenites* Goubin. *Pollen Spores*, **9(2)**, 357-362.	? samples as in Venk. & Kar '64. 1 genus, 1 specie. No frequency data. 1 pl. (15 figs.), description of the specie.
	VENKATACHALA, B. S. & KAR. R. K. ('67) July '68a. Palynology of the Karanpura sedimentary Basin, Bihar, India. — 1 Barakar Stage at Badam. *Palaeobotanist*, **16(1)**, 56-90.	60 samples, varied lithology. 4 surface sections, near Badam village. 42 genera (1 new), 60 species (21 new). % counts of genera. 10 pl. (99 figs.), descriptions of all species.
	BHARADWAJ, D. C. & TIWARI, R. S. ('66) Sept. '66. Sporological correlation of coal seams in Bachra area of North Karanpura Coalfield, Bihar, India. *Palaeobotanist*, **15(1, 2)**, 1-10.	18 samples; coal. 8 boreholes, Bachra area. 28 genera, no species. % counts of genera. 2 pl. (16 figs.), no descriptions.
	VENKATACHALA, B. S. & KAR, R. K. ('67) Nov. '68c. Palynology of the North Karanpura Basin, Bihar, India. — 2. Barakar exposures near Lungatoo, Hazaribagh district. *Palaeobotanist*, **16(3)**, 258-269.	9 samples, varied lithology. 1 surface locality near Lungatoo. 34 genera, 62 species (11 new). % counts of genera. 2 pl. (26 figs.), descriptions of new species.
(? age)	MAHESHWARI, H. K. & KAR, R. K. July '67. *Tiwariasporites* gen. nov., a new spore genus from the Permian of Congo & India. *Curr. Sci.*, **36(14)**, 367-370.	? samples. ? localities. 1 genus (new), 1 specie (new). No frequency data. 1 pl. (7 figs.) description of new specie.
Full Permian Succession	KAR, R. K. ('71) Aug. '73. Palynological delimitation of the Lower Gondwanas in the North Karanpura sedimentary Basin, India. *Palaeobotanist*, **20(3)**, 300-317.	Based on earlier works by Kar; Venk. & Kar. + ? samples from 2 new boreholes (KMB19, KB21). Numerous genera, no species. % counts of genera. No plates, no descriptions.

6. CHOPE COALFIELD

(? age)	GHOSH, A. K., CHANDIOK, K. P. & SEN, J. '47. Microfossils of Chope Coalfield Bihar. *Bull. Bot. Soc. Bengal*, 67-70.	(Not seen)

6. BOKARO COALFIELD

Barakar Fm. (M. Ecca)	BHARADWAJ, D. C. & TIWARI, R. S. ('63) May '64a TIWARI, R. S. ('63) Nov. '64	(see India, general)
Talchir Fm. (Dwyka)	TIWARI, R. S. ('64) Oct. '65. LELE, K. M. (symp. '64) '66.	
(? age)	SURANGE, K. R., SRIVASTAVA, P. N. & SINGH, P. '53.	(see bibliography in Tiw. '64).

J. E. DAMODAR V.

1. GIRIDIH (KARHARBARI) COALFIELD

Karharbari & Barakar Fm. (L. Ecca & M. Ecca)	GUHASARAKAR, T. K. '56.	(see bibliography in Tiw. '64)
Karharbari Fm. (L. Ecca)	SEN. J. '53. Principles and problems of microfloral correlations of Indian coal seams with special reference to Karharbari Coalfield. *Bull. natn. Inst. Sci. India*, **2**, 129-140.	? samples, (2 seams). ? collieries. 28 miospore types (no names given). Rel. frequency data. No plates, brief descriptions of all species.
	LELE, K. M. & MAITHY, P. K. ('63) Nov. '64. An unusual monosaccate spore from the Karharbari State, Giridih Coalfield, India. *Palaeobotanist*, **12(3)**, 307-312.	? samples, shale. 1 colliery (Serampur Colliery). 1 genus (new), 1 specie (new). No frequency data. 1 pl. (7 figs.), description of the new specie.
	MAITHY, P. K. ('64) Nov. '65. Studies in the Glossopteris flora of India — 27. Sporae dispersae from the Karharbari Beds in the Giridih Coalfield, Bihar. *Palaeobotanist*, **13(3)**, 291-307.	? samples, shale. ? collieries & stream cuttings, throughout coalf. 27 genera, 42 species (15 new). Brief rel. frequency data of genera. 7 pl. (49 figs.), descriptions of all species.
Talchir Fm. (Dwyka)	SURANGE, K. R. & LELE, K. M. ('55) Dec. '56. Studies in the Glossopteris flora of India — 3. Plant fossils from the Talchir needle shales from Giridih Coalfield. *Palaeobotanist*, **4**, 153-157.	? samples, plant bearing shale. 1 stream cutting, Sukni River. 7 miospore types (no names given). No frequency data. 2 pl. (8 figs.), brief descriptions of all species.
	LELE, K. M. (symp. '64) '66.	(see India, general)

2. JAINTI COALFIELD

Talchir Fm. (Dwyka)	LELE, K. M. & KARIM, R. ('70) Sept. '71. Studies in the Talchir flora of India — 6. Palynology of the Talchir boulder beds in Jayanti Coalfield, Bihar. *Palaeobotanist*, **19(1)**, 52-69.	2 samples, boulder beds. 1 stream section, Patharjore Nala. 40 genera, 74 species (15 new). % counts of genera. 3 pl. (38 figs.), descriptions of new species.

3. JHARIA COALFIELD

Raniganj Fm. (Daptocephalus Zone)	BANDYOPADHYAY, N. N. (symp. '67) '69a.	(see India, general)
	BANDYOPADHYAY, N. N. '69b *Sensispora* — A new alete miospore from the Raniganj Stage (upper Permian) of India. In: *J. Sen. Memorial Volume.* pp. 147-152.	? samples, coal. ? localities, Mahuda basin. 1 genus (new), 2 species (new). No frequency data. 2 pl. (14 figs.), descriptions of the 2 species.
Barren M. (U. Ecca)	BHARADWAJ, D. C., SAH, S. C. D. & TIWARI, R. S. ('64) Oct. '65. Sporological analysis of some coal & carbonaceous shale from Barren Measure Stage (Lower Gondwana) of India. *Palaeobotanist*, **13(2)**, 222-226.	15 samples, coal & shale. 2 surface localities, Sibbabudih & Katri nalas. 32 genera, no species. % counts of genera. 3 pl. (26 figs.), no descriptions.
	VENKATACHALA, B. S. & KAR, R. K. ('66) Sept. '66a. *Divarisaccus* gen. nov., a new saccate pollen genus from the Permian Sediments of India. *Palaeobotanist*, **15(1, 2)**, 102-106.	samples as in Kar '68a. 1 genus (new), 1 specie (new). No frequency data. 1 pl. (4 figs.), description of the specie.
	KAR, R. K. (symp. '64) '66. Palynology of the Barren Measures sequence from Jharia Coalfield, Bihar — 1. Summary and Discussion. In: *Symp. Floristics & Strat. Gondw. Lucknow.* pp. 121-127.	samples as in Kar '68a. 39 genera, no species. No frequency data. No plates, no descriptions.
	KAR, R. K. ('67), Sept. '68a Palynology of the Barren Measures sequence from Jharia Coalfield, Bihar, India — 2. General palynology. *Palaeobotanist*, **16(2)**, 115-140.	28 (269) samples, varied lithology. 1 borehole (J.K.5, 3926 ft. section). 38 genera, 67 species (35 new). No frequency data. 4 pl. (98 figs.), descriptions of new species.
	KAR, R. K. ('67) Nov. '68b. A fossil resembling *Pediastrum* from the Barren Measures Sequence of Jharia Coalfield, Bihar, India. *Palaeobotanist*, **16(3)**, 216-218.	samples as in Kar '68a. 1 genus, 1 species (algal colony). 1 Specimen. 1 pl. (5 figs.), description of the specie.

4. RANIGANJ COALFIELD

Panchet Fm. (Lystrosaurus Zone)	SRIVASTAVA, R. N. & PAWDE, M. B. '62. Palynological study of borehole R.O.1(B), Ondal, West Bengal. *Rec. geol. Surv. India,* **91(2)**, 369-384.	(not seen)
	SATSANGI, P. O., CHANDRA, A. & SINGH, G. '68.	(see bibliography in Kar. '70a)
	KAR, R. K. ('69) March '70a. Sporae dispersae from Panchet (Lower Triassic) in the bore-core no. RE.9, Raniganj Coalfield, West Bengal. *Palaeobotanist,* **18(1)**, 50-62.	3(6) samples, green & green-grey shale. 1 borehole (RE.9), E. Raniganj. 24 genera (4 new), 39 species (17 new). % counts of genera. 2 pl. (48 figs.), descriptions of new species.
Raniganj to Panchet Fms. (Daptocephalus to Lystro- saurus Zones)	KAR, R. K. ('69) Sept. '70b. Palynological distinction between Upper Permian & Lower Triassic in Raniganj Coalfield, Bengal, India. *Palaeobotanist,* **18(2)**, 118-126.	? samples (numerous), varied lithology. 19 surface locs., 3 boreholes, throughout coalf. *Panchet Stage:* 24 genera , no species. *Raniganj State:* 69 genera, no species. % counts of genera. No plates, no descriptions.
	SARBADHIKARI, T. R. Nov. '72. Gondwana miospores from a borehole in the Raniganj Coalfield, India. *Bull. geol. Min. metall. Soc. India,* **45**, 1-26.	5 samples, carb. shale & shaly sdst. 1 borehole (RE-1) E. Raniganj. 13 genera, 16 species (3 new). Absolute counts of genera. 3 pl. (25 figs.), descriptions of all species.
Raniganj Fm. (Daptocephalus Zone)	SEN, J. '44.	(see bibliography in Bharad '62)
	GHOSH, A. K. & SEN, J. '48. A study of the microfossils and the correlation of some productive coal seams of the Raniganj Coalfield, Bengal, India. *Trans. Min. geol. metall. Inst. India,* **43(2)**, 67-95.	Numerous samples, mostly coal. 3 collieries (5 seams) & other odd samples. ±52 miospore types (no names given). % counts of a few species. No plates, brief descriptions of all species.
	SRIVASTAVA, P. N. ('54) Dec. '55. Studies in the Glossopteris flora of India: 1. Some new fossil plants from the Lower Gondwanas of the Raniganj Coalfield, India. *Palaeobotanist,* **3**, 70-78.	1 sample, sorus of a fertile ferm pinna. ? locality. 1 spore type (no name given). Spre cluster with abundant specimens. 2 pl. (2 figs.), brief description of the specie.
	BHATTACHARYA, D. RAYCHOWDHURY, T. & DATTA, K. '57.	(see India, general)
	SURANGE, K. R. ('57) May '58. Studies in the Glossopteris flora of India — 9. A male fructification bearing monolete spores from the Lower Gondwana of India. *Palaeobotanist,* **6(1)**, 47-48.	1 sample, male fructification. 1 colliery (New Kenda). 1 spore type (no name). 1 pl. (3 figs.), description of the spore type.
	BHARADWAJ, D. C. ('60) Feb. '62. The miospore genera in the coals of Raniganj Stage (Upper Permian), India. *Palaeobotanist,* **9(1, 2)**, 68-106.	204 samples, coal (11 seams). 14 collieries, E. Raniganj. 43 genera (15 new), 28 species (17 new). No frequency data. 22 pl. (286 figs.), descriptions of all species.
	BHARADWAJ, D. C. & SALUJHA, S. K. ('63) May '64. Sporological study of seam VIII in Raniganj Coalfield, Bihar, India — Part I. Description of sporae dispersae. *Palaeobotanist,* **12(2)**, 181-215.	46 samples, coal (seam VIII). 4 collieries, E. Raniganj. 39 genera (2 new), 86 species (44 new). No frequency data. 12 pl. (171 figs.), descriptions of all species.
	BHARADWAJ, D. C. & SALUTHA, S. K. ('64) March '65b. Sporological study of seam VIII in Raniganj Coalfield, Bihar, India — Part II. Distribution of sporae dispersae and correlation. *Palaeobotanist,* **13(1)**, 57-73.	Samples as in Bharad. & Sal. '64. 39 genera, 86 species. % counts of genera., No plates, no descriptions.
	BHARADWAJ, D. C. & SALUJHA, S. K. ('64) March '65a. A sporological study of seam VII (Jote Dhemo Colliery) in the Raniganj Coalfield, Bihar, India. *Palaeobotanist,* **13(1)**, 30-41.	15 samples, coal (seam VII). 1 colliery, E. Raniganj. 40 genera, 85 species (13 new). % counts of genera. 2 pl. (41 figs.), descriptions of new species.
	SALUJHA, S. K. ('64) Nov. '65. Miospore assemblage of seam IX of East Raniganj Coalfield, India. *Palaeobotanist,* **13(3)**, 227-238.	10 samples, coal (seam IX). 1 colliery, E. Raniganj. 32 genera, 72 species (11 new). % counts of genera. 2 pl. (37 figs.), descriptions of new species.
	GHOSH, A. K. '65. Correlation of Poniati, Koithee & Rana seams around Baraboni, Raniganj Coalfield, district Burdwan, West Bengal, based on palynological evidence. *Proc. natn. Inst. Sci. India,* **30(3 & 4)**, 136-149.	(Not seen)
Raniganj Fm. (Daptocephalus Zone)	NAVALE, G. K. B. & SRIVASTAVA, S. C. ('70) Aug. '72. A microscopic study of some Raniganj coals. *Palaeobotanist,* **19(3)**, 263-269.	6 samples, composite coals (5 seams). 6 collieries, throughout coalfield. 21 genera, 38 species. % counts of genera. No plates, no descriptions.
	PANT, D. D. & NAUTIYAL, D. D. '60. Some seeds & sporangia of *Glossopteris flora* from Raniganj Coalfield, India. *Palaeontographica,* **170B**, 41-64.	(not seen)
	PANT, D. P. & BHATNAGAR, S. ('71) Aug. '73. Intraspecific variation in *Striatites* spores. *Palaeobotanist,* **20(3)**, 318-324.	? no of Arberiella sporangia (2 species) from coaly shale. ? localities. 1 genus, 2 species (1 new). No frequency data. 3 pl. (23 figs.), descriptions of the 2 species.
(? age)	BHATTACHARYA, A. D., RAYCHOWDHURY, T & DATTA, K. '57.	(see India, general)

5. BANSLOI COALFIELD

Barakar Fm. (M. Ecca)	MAHESHWARI, H. K. ('66) March '67. Studies in the Glossopteris flora of India — 29. Miospore assemblage from the Lower Gondwana exposures along Bansloi River in Rajmahal Hills, Bihar. *Palaeobotanist,* **15(3)**, 258-280.	? samples, plant bearing shale. 9 surface localities, throughout coalfield. 34 genera (1 new), 64 species (23 new). No frequency data. 9 pl. (74 figs.), descriptions of all species.
	MAHESHWARI, H. K. (symp. '64) '66. Studies in the Glossopteris flora of India — 30. Remarks on the age of the Lower Gondwana beds in Bansloi Valley, Santhal Parganas, Bihar. In: *Symp. Floristics & Strat. Gondw. Lucknow.* pp. 110-120.	samples as in Mahesh. '67. 34 genera, no species. Brief frequency data. No plates, no descriptions.

GENERAL

a) PAPERS CONCERNING MORE THAN 1 COALFIELD

G2, I6. BOKARO & KORBA COALFIELDS

Barakar Fm. (M. Ecca)	BHARADWAJ, D. C. & TIWARI, R. S. ('63) May '64a. On two monosaccate genera from Barakar Stage of India. *Palaeobotanist,* **12(2)**, 139-146.	samples as in Tiw. '65. 2 genera (new), 2 species (new). No frequency data. 2 pl. (13 figs.), descriptions of the 2 species.
	TIWARI, R. S. ('63) Nov. '64. New miospore genera in the coals of Barakar Stage (Lower Gondwana) of India. *Palaeobotanist,* **12(3)**, 250-259.	samples as in Tiw. '65. 6 genera (all new), 7 species (all new). No frequency data. 1 pl. (12 figs.), descriptions of all species.
	TIWARI, R. S. ('64) Oct. '65. Miospore assemblage in some coals of Barakar Stage (Lower Gondwana) of India. *Palaeobotanist,* **13(2)**, 168-214.	**Korba Cf.** 35 samples coal ? boreholes, E. & W. sectors of coalfield. **W. Bokaro Cf.** 21 samples, coal (3 seams). 4 collieries & 1 quarry. 53 genera, 131 species (59 new). % counts of genera. 9 pl. (217 figs.), descriptions of all species.

F1, G3, H1, 4. CHIRIMIRI, SOHAGPUR, BISRAMPUR & TALCHER COALFIELDS.

Barakar Fm. (M. Ecca)	BHARADWAJ, D. C. & SRIVASTAVA, S. C. ('68) July '69a Some new miospores from Barakar Stage Lower Gondwana, India. *Palaeobotanist,* **17(2)**, 220-229.	? samples, coal. ? localities. 3 genera (all new), 5 species (all new). No frequency data. 2 pl. (25 figs.), descriptions of all species.

H5, I6, J1, BOKARO, GIRIDIH & JOHILLA COALFIELDS

Talchir Fm. (Dwyka)	LELE, K. M. '66. Studies in the Talchir flora of India — 4. Quest for the early traces & subsequent development of the Glossopteris flora in the Talchir Stage. In: *Symp. Floristics & Strat. Gondw., Lucknow.* pp. 85-97.	The geographic distribution of 29 genera and 45 species of miospores occurring in the Talchir Fm. of these 3 Indian coalfields is tabled and discussed.

I3, J3, S. KARANPURA & JHARIA COALFIELDS

Barakar & Raniganj Fms. (M. Ecca & Daptocephalus Zone)	BANDYOPADHYAY, N. N. (symp. '67) '69a. Sporological studies & mio-floristic provinces of Lower Gondwanas of India & stratigraphical evaluation. In: *I.U.G.S. Gondw. Symp. 1, Buenos Aires.* pp. 3-19.	The genera of Barakar coals of the S. Karanpura Cf. and the Raniganj coals of Jharia Cf. are recorded & % counts given.

I3, J4. S. KARANPURA & RANIGANJ COALFIELDS

(? age)	BHATTACHARYA, D., RAYCHOWDHURY, T. & DATTA, K. '57.	(see bibliography in Tiw. '64)

H3, 6. MANENDRAGARH DISTRICT & UMARIA COALFIELDS

L. Talchir to L. Karharbari Fms (Dwyka to L. Ecca)	LELE, K. M. & CHANDRA, A. ('70) Aug. '72. Palynology of the marine intercalations in the Lower Gondwana of Madhya Pradesh, India. *Palaeobotanist*, **19(3)**, 253-262.	? samples, invertebrate bearing sediments. 2 surface sections, near Umaria & Manendragarh stations. 14 genera, 24 species (9 new). Brief frequency data. 2 pl. (28 figs.), descriptions of new species.

b) PAPERS CONCERNING INDIA IN GENERAL

Full Permian Succession	CHANDRA, A., KHAN, A. M. & SINGH, G. '64. Distribution of microspores in the Lower Gondwana formations of India. In: *Int. Geol. Congr. 22 (Part 9, Gondw.), India.* pp. 26-37.	A brief account of the chief miospore characteristics of the various stages within the Permian (Talchir to Panchet) of India is given.
Full Permian Succession	BHARADWAJ, D. C. (symp. '64) '66. Distribution of spores & pollen grains dispersed in the Lower Gondwana formations of India. In: *Symp. Floristics & Strat. Gondw., Lucknow.*, pp. 69-84.	The stratigraphic distribution & % frequency of 45 genera of miospores through the Permian strata (Talchir to Raniganj Stages) of India (9 coalfields) is tabled and discussed.
Karharbari Fm. (L. Ecca)	MAITHY, P. K. (symp. '64) '66b Palaeobotany & stratigraphy of the Karharbari Stage with particular reference to the Giridih Coalfield, India. In: *Symp. Floristics & Strat. Gondw., Lucknow.*, pp. 102-109.	A brief account of the chief miospore characteristics of the Karharbari Stage is given and compared with those of the Talchir & Barakar Stages.
Karharbari Fm. (L. Ecca)	MAITHY, P. K. '69b The contemporaneity of the Karharbari flora in Gondwanaland. In: *J. Sen. Memorial Volume.* pp. 279-298.	The geographic distribution of 56 genera & 95 species of miospores occuring in the Karharbari Stage of 9 Indian coalfields is tabled & discussed.
Full Permian Succession	BHARADWAJ, D. C. '70. Palynostratigraphy of Lower Gondwana succession in India. *Ann. Dept. Geol. A.M.U.*, **5.**	Not seen.
Full Permian Succession	BHARADWAJ, D. C. (symp. '70) Jan. '72. Palynological subdivision of the Gondwana sequence in India. In: *I.U.G.S. Gondw. Symp. 2, South Africa.* pp. 531-536.	The stratigraphic distribution & relative frequency of the major groups of miospores through the Permian strata (Talchir to Panchet Stages) of India is tabled & discussed.
Full Permian Succession	VENKATACHALA, B. S. ('70) Aug. '72. Observations on some palynological contributions to Indian stratigraphy. *Palaeobotanist*, **19(3)**, 284-296.	The stratigraphic distribution & relative frequency of 64 genera of miospores through the Permian strata (Talchir to Panchet Stages) of India is tabled & discussed.
Full Permian Succession	SURANGE, K. R. (symp. '73) in press. A review of the Indian Lower Gondwana flora. In: *I.U.G.S. Gondw. Symp. 3, Canberra.*	(summary only seen)

AUSTRALASIA

14. PERTH BASIN

A. COLLIE B.

U. & L. Perm. coal measures (M. Ecca & Daptocephalus Zone)	BALME, B. E. '52. The principal microspores of the Permian coals of Collie. pp. 164-201. In. Lord, J. H., Collie Mineral Field. *Bull. geol. Surv. West. Aust.*, **105(1)**, 1-247.	61 samples, coal. 3 boreholes, 5 collieries. 34 miospore types (no names given). % counts of species. 1 pl. (5 figs.), descriptions of all species.
Full Permian Succession	GLICKSON, M. '72. *Permian palynology of the Collie Basin, West Australia.* *Univ. W. Aust. (unpubl. Ph.D. Thesis).*	(plates & species lists only seen). 55 genera (3 new), 84 species (10 new). 42 pl. (352 figs.).

B. N. PERTH B.

Full Permian Succession	BALME, B. E. & SEGROVES, K. L. ''66. Peltacystia gen. nov.: a microfossil of uncertain affinities from the Permian of Western Australia. *J. Proc. R. Soc. West. Aust.*, **49(1)**, 26-31.	3 samples, coal & grey siltstone. 3 boreholes, 2 areas within N. Perth Basin. 1 gen (new), 3 species (all new). No frequency data. 1 pl. (15 figs.), descriptions of all species.
	SEGROVES, K. L. '67. Cutinized microfossils of probable nonvascular origin from the Permian of western Australia. *Micropaleontology*, **13(3)**, 289-305.	9 samples, varied lithology. 8 boreholes, N. Perth Basin. 13 genera (4 new), 18 species (8 new) Frequency notes on some species. 3 pl. (40 figs.), descriptions of all species.
	SEGROVES, K. L. '69. Saccate plant microfossils from the Permian of Western Australia. *Grana palynol.*, **9(1-3)**, 174-227.	samples as in Segr. '70. Saccate pollen grains considered. 16 genera, 29 species (5 new). No freq. data, Strat. distrib. of each species. 13 pl (69 figs.), descriptions of all species.
	SEGROVES, K. L. '70. Permian spores & pollen grains from the Perth Basin, Western Australia. *Grana palynol.*, **10(1)**, 43-73.	300 samples, varied lithology. 59 boreholes & ? surface locs., N. Perth B. Spores & non-saccate pollen grains considered. 28 genera (1 new), 49 species (12 new). No freq. data; Strat. distrib. of each species. 11 pl. (96 figs.); descriptions of all species.
	SEGROVES, K. L. (symp. '70) Jan. '72. The sequence of palynological assemblages in the Permian of the Perth Basin, Western Australia. In: *I.U.G.S. Gondw. Symp. 2, South Africa.* pp. 537-540.	samples as in Segr. '70. 57 genera, 97 species. % counts of major taxa & of some species. 7 pl. (69 figs.), no descriptions.

15. CARNARVON BASIN

A. N. CARNARVON B.

Full Permian Succession	BALME, B. E. '67. Palynological Report No. 247. In: Jones, D. K., Onslow No. 1, well completion report. *Wapet* (unpubl.)	7 samples, varied lithology. 1 borehole (Onslow 1). Many genera and species. No frequency data. No plates, no descriptions.

16. CANNING BASIN

A. CANNING B.

Full Permian Succession	SEGROVES, K. L. '67. Cutinized microfossils of probable nonvascular origin from the Permian of Western Australia. *Micropaleontology*, **13(3)**, 289-305.	2 samples, silty sdst. & carb. shale. 2 boreholes (Frome Rocks 1, Dampier Downs 1). 3 genera (1 new), 6 species (3 new). Frequency notes on some species. 2 pl. (11 figs.), descriptions of all species.
	BALME, B. E. '68. Palynological Report No. 278. In: Johnson, N. E. A., Blackstone No. 1, well completion report. *Wapet* (unpubl.).	53 samples, varied lithology. 1 borehole (Blackstone 1). Many genera & species. % counts of species. No plates, no descriptions.
	BALME, B. E. '73. Permian palynology of the Canning Basin, West Australia. *Univ. W. Aust.* (unpubl. report).	(plates & species list only seen). Many genera & species. 9 pl. (160 figs.)

17. S. AUSTRALIA

A. PEDIRKA B.

Crown Point Fm. (Dwyka)	EVANS, P. R. '64b Lower Permian microfloras from the Crown Point Formation, Finke area, Northern Territory. *Bur. Min. Resour. Aust. Rec.*, **1964/196**, 1-30 (unpubl.)	11 samples, varied lithology. 4 short boreholes, **N. W. Pedirka Basin.** 28 genera, 31 species. Brief frequency data. 9 pl. (61 figs.), descriptions of 2/3 the species.

B, C. N. & S. ARCKARINGA B.

L. Perm. c.m. (M. Ecca)	BALME, B. E. '57. Upper Palaeozoic microfloras in sediments from the Lake Phillipson Bore, South Australia. *Aust. J. Sci.*, **20**, 61-62.	5 samples, varied lithology. 1 borehole (Lake Phillipson), **N. Arckaringa B.** 8 genera, 6 species. Brief frequency data. No plates, no descriptions.

Stages 2 to 4 of Evans '67a (Dwyka to M. Ecca)	HARRIS, W. K. & McGOWRAN, B. Jan. '68. S.A.G. Cootanoorina No. 1 well; Upper Palaeozoic and Lower Cretaceous micropalaeontology; Grid G/3. *Dept. Mines S. Aust.*, **Pal. 1/68**, 1-32 (unpubl.)	19 samples, ? lithology. 1 borehole (Cootanoorina), **S. Arckaringa B.** 28 genera, 33 species. Brief frequency data. No plates, no descriptions.

D. EUCLA B.

(Dwyka)	HARRIS, W. K. & LUDBROOK, N. H. Jan. '66. Occurrence of Permian sediments in the Eucla Basin, South Australia. *Q. geol. Notes, geol. Surv. S. Aust.*, **17,** 11-14.	? no of samples, grey claystone. 1 borehole (Nullarbor 8), **Eucla Basin.** 18 genera, 20 species. Brief frequency data. 1 pl. (2 figs.), no descriptions.

E. TROUBRIDGE B.

(Dwyka)	HARRIS, W. K. & McGOWRAN, B. Oct. '71. Permian & reworked Devonian microfossils from the Troubridge Basin. *Q. geol. Notes, geol. Surv. S. Aust.*, **40**, 5-11.	4 samples, ? lithology. 3 boreholes, 1 surface loc., **Troubridge B.** 26 genera, 29 species. Brief frequency data. No plates, no descriptions.

H. BACCHUS MARSH

(Dwyka)	VIRKKI, C. '39. On the occurrence of similar spores in a Lower Gondwana glacial tillite from Australia & in Lower Gondwana shales in India. *Proc. Indian Acad. Sci. Section B.*, **9,** 7-12.	1 sample, tillite. 1 surface loc. Coimadai Creek, **Bacchus M.** 1 miospore type (no name given). No frequency data. 1 pl. (5 figs.), brief description of the specie.
	VIRKKI, C. ('45) April '46. Spores from the Lower Gondwanas of India & Australia. *Proc. Indian Acad. Sci.*, **15(4, 5)**, 93-176.	samples as in Virk. '39. Many miospore types (majority unnamed). No frequency data. 1 pl. (10 figs.), brief descriptions of all species.
	PANT, D. D. '42. PANT, D. D. '43.	(see bibliography in Pant & Mehra '63)
	PANT, D. D. '49. On the occurrence of *Pityosporites* Seward in a Lower Gondwana tillite from Australia and its possible relationships with *Glossopteris*. In: *Indian Sci. Congr. 36 (Part 4), Allahabad.* pp. 10-11.	1 sample, tillite. 1 surface locality, **Bacchus Marsh.** 1 genus, no species. No frequency data. No plates, no descriptions.
	PANT, D. D. Oct. '55. On two new disaccate spores from the Bacchus Marsh Tillite, Victoria (Australia). *Ann. Mag. nat. Hist. Ser. 12*, **8**, 757-764.	samples as in Pant '49. 2 genera, 2 species (1 new). No frequency data. 1 pl. (2 figs.), descriptions of the 2 species.
	PANT, D. D. & MEHRA, B. '63. On the occurrence of glossopterid spores in the Bacchus Marsh Tillite, Victoria, Australia. *Grana palynol*, **4(1)**, 111-120.	samples as in Pant '49. 5 genera (2 new), 5 species (2 new). Frequency data on species. 1 pl. (9 figs.), descriptions of all species.

F. G. H. (see table of localities)

(Dwyka)	DOUGLAS, J. G. (symp. '68) Aug. '69. An assessment of the geological age of some Victorian 'glacial' beds. *Spec. Publs. geol. Soc. Aust.*, **2**, 57-60.	A review of the miospores known to date from the Victorian glacial beds. ? surface localities, 3 areas. 15 genera, 17 species. Brief frequency data. No plates, no descriptions.

18. QUEENSLAND

A, B. S.W. & N.E. COOPER B.

Full Permian Succession	EVANS, P. R. '66c. Palynological comparison of the Cooper and Galilee Basins. *Bur. Min. Resour. Aust. Rec.*, **1966/222** 1-16 (Unpubl.)	18 samples, ? lithology. 5 boreholes (Gidgealpa 3, Gidgealpa 1, Dullingari 1, Orientos 1, Chandos 1), **S.W. & N.E. Cooper Basin** Many genera & species. Some frequency data on species. No plates, no descriptions.
	PATEN, R. J. '69. Palynologic contributions to petroleum exploration in the Permian formations of the Cooper Basin, Australia. *APEA Jl.*, 79-87.	An account of the stratigraphic distribution of the most significant miospores through the Permian succession (Stages 2 to 5) in the **S.W. Cooper Basin.**

C, D. N. & S. GALILEE B.

Full Permian Succession	HILL, D. & WOODS, J. T. *eds.* ± '63. Permian index fossils of Queensland. *Qd. Palaeontograph. Soc. Brisb.*, 1-31.	6 samples, ? lithology. 3 boreholes (Maranda 1, Entonvale 1), **S. Galilee Basin.** (with 1 fig. from Minima 1 in S. Bowen Basin) 10 genera, 14 species. No frequency data. 1 pl. (17 figs.) very brief descriptions of all species.
	EVANS, P. R. '64a. Some palynological observations on samples from the North-Eastern Eromanga Basin, Central Queensland. *Bur. Min. Resour. Aust. Rec.*, **1964/76**, 1-10 (unpubl.)	3(6) samples, shale & varved mudstone. 1 surface section (Galah Gorge), **N. Galilee B.** 15 genera, 19 species. Brief frequency data on major taxa. No plates, no descriptions.
	EVANS, P. R. '66a. Palynological studies in Longreach, Jericho, Galilee, Tambo, Eddystone & Taroom 1:250 000 sheet areas, Queensland. *Bur. Min. Resour. Aust. Rec.*, **1966/61** 1-32 (unpubl.)	18 samples, ? lithologies. 5 boreholes (Galilee 1, Jericho 1, BMR 32, BMR 33, Birkhead 1) **N. & S. Galilee B.** Many genera & species. Brief frequency data on major taxa. No plates, no descriptions.
	BURGER, D. '70. Palynological Observations on Amoco Towerhill No. A-1 Well, Galilee Basin, Queensland. *Bur. Min. Resour. Aust. Rec.*, **1970/26** 1-10 (unpubl.)	7 samples, ? lithology. 1 borehole (Towerhill A-1) **N. Galilee Basin.** 19 genera, 22 species. Some brief frequency data. No plates, no descriptions.
	NORVICK, M. '71. Some palynological observations on Amerada Thunderbolt No. 1 Well, Galilee Basin, Queensland. *Bur. Min. Resour. Aust. Rec.* **1971/53**, 1-19 (unpubl.)	24 samples ? lithology. 1 borehole (Thunderbolt 1), **N. Galilee Basin.** Many genera & species. Some brief frequency data. No plates, no descriptions.
	RIGBY, J. F. May '73. Permian palynology of the lower part of Galilee NS 5 Bore, Central Queensland. *Qd. Govt. Min. J.*	5(6) samples, light grey shale. 1 borehole (Galilee NS/5), **S. Galilee B.** Many genera & species. % counts of species per sample. No plates, no descriptions.

E, F. N. & S. BOWEN B.

L. & U. Perm. c.m. (M. Ecca & Daptocephalus Zone)	de JERSEY, N. J. Oct. '46. Microspore types in some Queensland Permian coals. *Pap. Dep. Geol. Univ. Qd*, **3(5)**, 1-12.	? samples, coal ? localities, 5 coalfields (Collinsville, Blair Athol, Blackwater, Bluff, Mt. Mulligan. I have only indicated the 1st 3 on map) **N. Bowen B.** 32 miospore types (no names given). No frequency data. No plates, very brief descriptions of all species.
Full Permian Succession	PATEN, R. J. Oct. '65. Palynology A.F.O. Arcturus No. 1 Well. *Minad Brisb. Memo.*, **2/3**, 1-6 (unpubl.)	22(23) samples, ? lithology. 1 borehole (Arcturus 1), **N. Bowen Basin.** Moderate no. of genera & species. Some brief frequency data on genera. No plates, no descriptions.
	EVANS, P. R. '66b. Contributions to the palynology of the Permian & Triassic of the Bowen Basin. *Bur. Min. Resour. Aust. Rec.*, **1966/134**, 1-12 (unpubl.)	Blackwater area — 15 samples, ? lithology. — 11 short boreholes. Blair Athol area — 1 sample, ? lithology. — 1 surface locality. **N. Bowen Basin** Many genera & species. Some brief frequency data on major taxa. 2 pl. (19 figs.), no descriptions.
Rewan Fm. (Lystrosaurus Zone)	de JERSEY, N. J. March '70. Early Triassic miospores from the Rewan Formation. *Publs. geol. Surv. Qd*, **345**, (Pal. pap.), **22**, 1-29.	9 samples, ? lithology. 3 short boreholes, Theodore area, **S. Bowen B.** Many genera, 54 + species. % counts & strat. distrib. of each species. A few pl. & figs., descriptions of some species.

G. CLARENCE/MORETON B.

Buaraba Mdst. (? age)	de JERSEY, N. J. April '73. Palynology of core samples from the Helidon, Toowoomba and Kulpi areas. *Qd Govt Min. J.*	2 samples, grey mudstone. 1 borehole (Ipswich 19-22R), **Clarence-Moreton Basin.** 10 genera, 10 species. No frequency data. No plates, no descriptions.

GENERAL

Full Permian Succession	EVANS, P. R. '64c. A correlation of some deep wells in the North-Eastern Eromanga Basin, Central Queensland. *Bur. Min. Resour. Aust. Rec.*, **1964/197**, 1-12 (unpubl.)	A brief account of the stratigraphic distribution of miospores through the Permian succession in Queensland.

19. SYDNEY BASIN

A. NEW ENGLAND

Greta C.M. equiv. (M. Ecca)	McKELVEY, B. C. & GUTSCHE, H. W. (symp. '6B) Aus. '69 The geology of some Permian sequences on The new England Tablelands, New South Wales. *Spec. Publs. geol. Soc. Aust.*, **2**, 13-20.	1 sample, fine grained sandstone. ? locality, Ashford C. M., **New England Tableland.** 9 genera, 12 species. Brief frequency data. No plates, no descriptions.

B, C, D. (See table of localities)

U. Perm. c.m. (Daptocephalus Z.)	VIRKKI, C. '37 On the occurrence of winged spores in the Lower Gondwana rocks of India & Australia. *Proc. Indian Acad. Sci. Section B.*, **6**, 42B-431.	1 sample, plant bearing shale. 1 surface loc., Newcastle, **Hunter Valley.** 1 genus, 1 species (new). Brief frequency data. 1 pl. (5 figs.), description of the new specie.
	VIRKKI, C. ('45) April '46. Spores from the Lower Gondwanas of India & Australia. *Proc. Indian Acad. Sci.*, **15(4, 5)**, 93-176.	sample as in Virk. '37. 1 genus, 2 species. Frequency data on genera. 1 pl. (5 figs.), descriptions of the 2 species.
L. & U. Perm. c. m. (M. Ecca & Daptocephalus Z.)	DULHUNTY, J. A. '45. Principal microspore-types in the Permian coals of New South Wales. *Proc. Linn. Soc. N.S.W.*, **70(3,4)**, 147-157.	Samples as in Dulh. '46. 4B miospore types (no names given). No frequency data. 1 pl. (19 figs.), brief descriptions of all species.
	DULHUNTY, J. A. '46. Distribution of microspore types in New South Wales Permian Coalfields. *Proc. Linn. Soc. N.S.W.*, **71(5,6)**, 239-251.	57 samples, (26 seams). 47 locs., 7 coalfs., **S. Sydney B & Hunter V.** 4B miospore types (no names given). % counts of species. No plates, no descriptions.
U. Perm. c.m. (Daptocephalus Z.)	POTONIE, R. '56. Synopsis der gattungen der sporae dispersae, 1. Teil: Sporites. *Beih. geol. Jb.*, **23**, 1-103.	The genus & species Dulhuntyisporites dulhuntyi is coined & described after material in Dulh. '45.
Narrab. Grp. (Lystrosaurus Zone)	HENNELLY, J. P. F. '58. Spores and pollens from a Permian-Triassic transition, N.S.W. *Proc. Linn. Soc. N.S.W.*, **83(3)**. 363-369.	22 samples, green-grey shale. 1 borehole (Appin 4), **S. Sydney Basin.** 14 genera (1 new), 20 species (6 new). % counts of species per sample. 2 pl. (22 figs.), descriptions of the new species.
U Perm c.m. (Daptocephalus Z.)	PANT, D. D. Jan. '5Ba. The structure of some leaves and fructifications of the *Glossopteris* flora of Tanganyika. *Bull. Br. Mus. nat. Hist.*, **3(4)**, 127-175.	A few sporangia (Arberiella type). ? locality, Newcastle, **Hunter Valley.** 1 miospore type (no name given). Frequency data. No plates, brief description of the specie.
Full Permian Succession	EVANS, P. R. '67b. Review of the Permian palynology of the Sydney Basin, New South Wales. *Bur. Min. Resour. Aust. Rec.*, **1967/103**, 1-44 (unpubl.)	A review of earlier Perm. miospore work done in the basin, plus the following new data: 35 samples, varied lithology. 7 boreholes, 6 surface localities, **S. & N. Sydney Basin & Hunter Valley.** Many genera & species. Some frequency data. No plates, no descriptions.
U. Perm c.m. (Daptocephalus Z.)	DATTA, A. K. '69. Study on *Pityosporites.* In: *J. Sen. Memorial Volume.* pp. 139-145.	? samples (a few), shale. ? localities, Newcastle, **Hunter V.** 1 genus, 1 species. Brief frequency data. No plates, descriptions of the specie.
U. Perm. c.m. to Narrab. Grp. (Daptocephalus to Lystrosaurus Zones)	HELBY, R. '70. *The stratigraphic palynology of the Late Permian-Triassic sediments of the Sydney Basin.* Univ. Sydney. (unpubl. Ph.D. Thesis).	45 samples, varied lithology. 7 boreholes, 1 shaft, 1 surface section, **S. Sydney B.** 6B genera (1 new), 93 species (4 new). Rel. frequency data on species. Many pls. & figs., descriptions of all species.

20. TASMANIA

A. TASMANIA

L. & U. Perm. c. m. (M. Ecca & Daptocephalus Z.)	DULHUNTYI, J. A. & DULHUNTYI, R. '49. Notes on microspore types in Tasmanian Permian coals. *Proc. Linn. Soc. N.S.W.*, **74**, 132-139.	9 specimens, coal. 3 collieries, 6 surface localities. 46 miospore types (no names given). Frequency data on species. No plates, descriptions of all types.
Mersey Grp. c. m. (M. Ecca)	BANKS. M. R. Dec. '62. Permian *Chapt. V. in:* Spry, A. & Banks, M. R. *eds.* The geology of Tasmania. *J. geol. Soc. Aust.*, **9(2)**, 189-215.	? samples, ? lithology. ? localities. 7 genera, 8 species. No frequency data. No plates, no descriptions.
Cygnet C. M. (Daptocephalus Z.)	BANKS, M. R. & NAQVI, I. H. June '67. Formations close to the Permo-Triassic boundary in Tasmania. *Pap. Proc. R. Soc. Tasm.*, **101**, 17-30.	A review of the miospores known to date from the Cygnet Coal Measures. ? samples & localities, 4 areas. 15 genera, 18 species. No frequency data. No plates, no descriptions.

21. NEW ZEALAND

(No literature to date)

GENERAL

Full Permian Succession	BALME, B. E. & HENNELLY, J. P. F. '55. Bisaccate sporomorphs from Australian Permian coals. *Aust. J. Bot.*, **3(1)**, 89-98.	? samples, ? lithology. ? localities, general Australia (19 areas). 5 genera (1 new), 12 species (11 new). No frequency data. 6 pl. (64 figs.), descriptions of all species.
	BALME, B. E. & HENNELLY, J. P. F. '56a. Monolete, monocolpate, & alete sporomorphs from Australian Permian sediments. *Aust. J. Bot.*, **4(1)**, 54-67.	? samples, ? lithology. ? localities, general Australia (19 areas). 6 genera (2 new), 15 species (13 new). No frequency data. 3 pl. (67 figs.), descriptions of all species.
	BALME, B. E. & HENNELLY, J. P. F. '56b. Trilete sporomorphs from Australian Permian sediments. *Aust. J. Bot.*, **4(3)**, 240-260.	? samples, ? lithology. ? localities, general Australia (19 areas). 13 genera (2 new), 26 species (all new). No frequency data. 10 pl. (83 figs.), descriptions of all species.
	BALME, B. E. '64. The palynological record of Australian pre-Tertiary floras. In: *Ancient Pacific Floras.* pp. 49-B0.	Based on the study of over 1000 samples from some 64 locs. throughout Australia, The Permian strata are divided into 3 miospore assemblage zones. These are discussed. 35 genera, 3B species. Brief frequency notes. 2 pl. (3B figs.), no descriptions.
	EVANS, P. R. '67a. Upper Carboniferous and Permian palynological stages and their distribution in Eastern Australia. *Bur. Min. Resour. Aust. Rec.*, **1967/99**, 1-13 (unpubl.)	An account of the stratigraphic distribution of miospores through the Permian succession in E. Australia.
	EVANS, P. R. (symp. '67) '69. Upper Carboniferous and Permian palynological stages and their distribution in Eastern Australia. In: *I.U.G.S. Gondw. Symp. 1, Buenos Aires.* pp. 41-54	An account of the stratigraphic distribution of miospores through the Permian succession in E. Australia.
	SEGROVES, K. L. '67. Cutinized microfossils of probable non-vascular origin from the Permian of Western Australia *Micropaleontology*, **13(3)**, 2B9-305.	Acritarchs are described from: 14. Perth Basin, B. 16. Canning Basin A
Late Palaeozoic glacials (Dwyka)	HELBY, R. & McCLUNG, G. (symp. '73) in press. Microfloral and faunal evidence for dating Australian late Palaeozoic glacials. In: *I.U.G.S. Gondw. Symp. 3, Canberra.*	(summary only seen)

ANTARCTICA

22. TR. ANTARCTIC MTS.

A. GEORGE V. LAND

(? age)	PAVLOV '58.	(see bibliography in Balme & Playf. '58).

B. VICTORIA LAND

(?age)	SEWARD, A. A. '14. Antarctic fossil plants. In: *British Antarctic Expedition 1910. Nat Hist. Report,* London.	sample as in Sew. '33. 1 genus (new), 1 species (new). 2 specimens seen. 1 pl. (1 fig.), description of the new specie.
	SEWARD, A. A. Nov. '33. An Antarctic pollen-grain; fact or fancy? *New Phytol.*, **32(4)**, 311-313.	1 sample, siliceous matrix of fossil stem. 1 surface locality, boulder on Priestley Glacier. 1 genus, 1 species. 1 specimen seen. 1 pl. (1 fig.), no description.
Bastion C. M. (? age)	BALME (in Allen) '62.	(see bibliography in Balme & Playf. '58).
Darwin Tillite (Dwyka)	BARRETT, P. J. & KYLE, R. A. (symp. '73) in press. The early Permian glacial beds of South Victoria Land and the Darwin Mts, Antarctica. In: *I. U. G. S. Gondw. Symp. 3, Canberra.*	1(8) samples, shaly siltstone. 1 surface locality, Darwin Mts. 15 genera, 20 species. % counts of major taxa. No plates, no descriptions.
L. Weller C.M. (M. Ecca)	KYLE, R. A. (pers comm.) Dec. '73. *Palaeobotanical studies of the Beacon Supergroup in South Victoria Land and the Darwin Mountains, Antarctica.* Victoria Univ. of Wellington (thesis in preparation).	1 sample, fine grey sandstone. 1 surface locality, Shapeless Mountain. 18 genera, 20 species. Brief rel. frequency data on major taxa. 1 pl. (10 figs.), no descriptions.

C. OHIO RANGE

Mt. Glossopt. Fm. (?age)	SCHOPF '62. CRIDLAND '63.	(see bibliography in Balme & Playf. '58).
Buckeye Tillite (Dwyka)	SCHOPF (in Long) '64. RIGBY & SCHOPF (symp. '67) '69.	(see bibliography in Bar. & Kyle in press).
Late Palaeozoic glacials (Dwyka)	KEMP, E. M. (symp. '73) in press. The palynology of Late Paleozoic glacial deposits of Gondwanaland. In: *I. U. G. S Gondw. Symp. 3, Canberra.*	9(26) samples, diamictite. ? localities, Ohio & Wisconsin Ranges. 9 genera, 2 species. Brief rel. frequency data on major taxa & some genera. 1 pl. (9 figs.), no descriptions.

23. ANTARCTICA

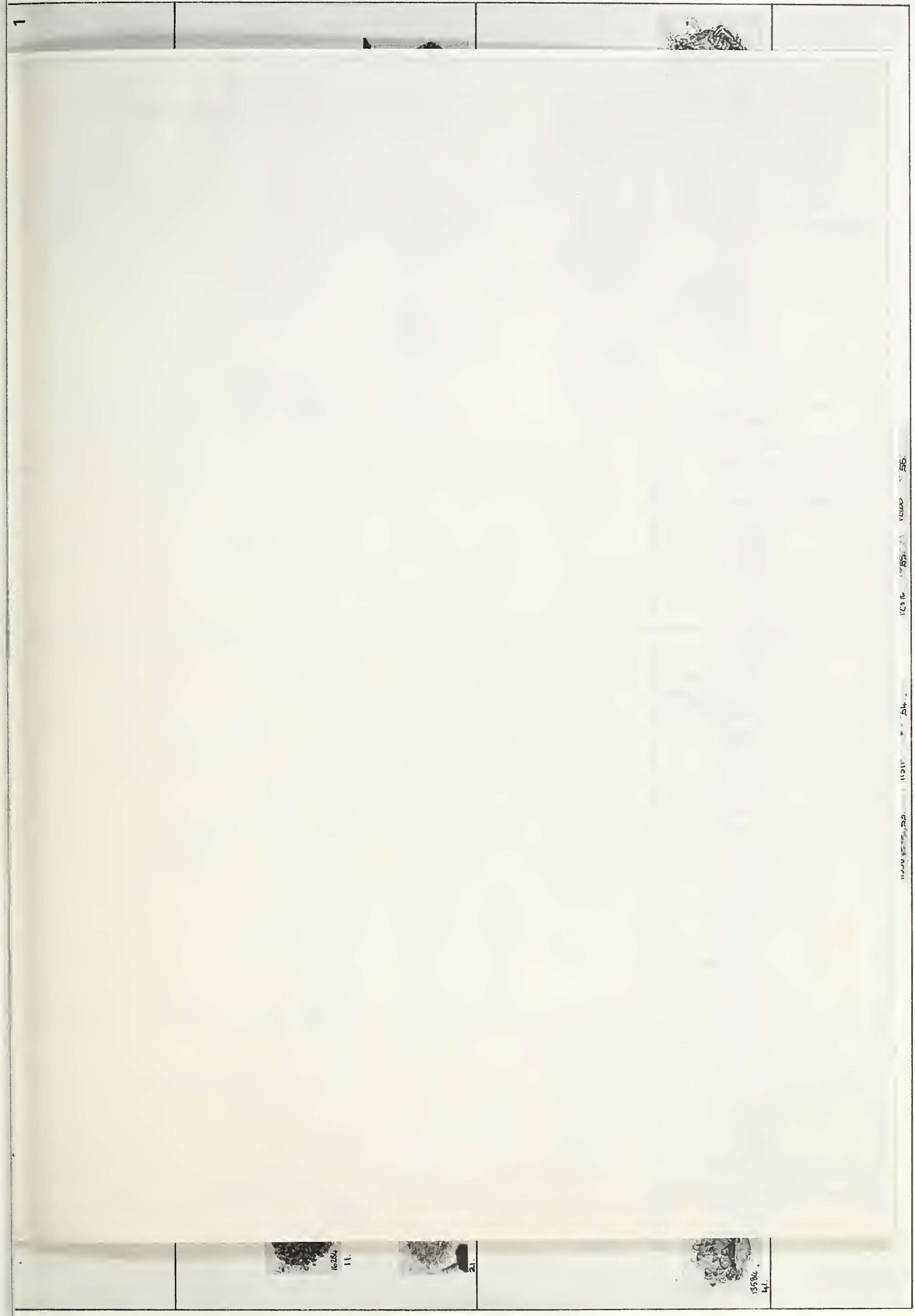
A. PRINCE CHARLES MTS.

Amery fm. (Daptocephalus Z.)	BALME & PLAYFORD '58. CROHN '59.	(see bibliography in Hart '69c) (see bibliography in Balme & Playf. '58)
	BALME, B. E. & PLAYFORD, G. Dec. '67. Late Permian plant microfossils from the Prince Charles Mountains, Antarctica. *Revue Micropaléont*, **3**, 179-192.	6 samples, coal & shale. 2 surface locs., 2 areas in Prince Charles Mts. 18 genera, 22 species. Rel. frequency data on species. 2 pl. (29 figs.), descriptions of all species.
	KEMP, E. M. '69. Palynological examination of samples from the Beaver Lake area, Prince Charles Mountains, Antarctica. *Bur. Min. Resour. Aust. Rec.*, **1969/96**, 1-7 (unpubl.)	8(10) samples, shales & siltstones. 10 surface locs., 2 areas in Prince Charles Mts. 18 genera, 24 species. No frequency data. No plates, no descriptions.

GENERAL

Various ages (see relevant entries)	VIRKKI, C. '37. On the occurrence of winged spores in the Lower Gondwana rocks of India & Australia. *Proc. Indian Acad. Sci. Section B.*, **6**, 428-431.	Material is described from: 12. Salt Range, A. 19. Sydney Basin, C.
	VIRKKI, C. '39. On the occurrence of similar spores in a Lower Gondwana glacial tillite from Australia & in Lower Gondwana shales in India. *Proc. Indian Acad. Sci. Section B.*, **9**, 7-12.	Material is described from: 12. Salt Range A. 13. India, H. I. 17. S. Australia, H.
	VIRKKI, C. ('45) April '46. Spores from the Lower Gondwanas of India & Australia. *Proc. Indian Acad. Sci.*, **15(4,5)**, 93-176.	Material is described from: 12. Salt Range A. 13. India, H, I. 17. S. Australia, H. 19. Sydney Basin, C.
	PANT, D. D. Jan. '58a. The structure of some leaves and Fructifications of the *Glossopteris* flora of Tanganyika. *Bull. Br. Mus. nat. Hist.*, **3(4)**, 127-175.	Material is described from: 7. Zambia, A. 19. Sydney Basin, C.
	TOWNROW, J. A. '62. On some disaccate pollen grains of Permian to Middle Jurassic age. *Grana palynol.*, **3(2)**, 13-44.	Material is re-described from: 7. Zambia, A. 13. India, J.
Full Permian Succession	HART, G. F. (symp. '63) 1964a. A review of the classification and distribution of the Permian miospore: disaccate striatiti. In: *Congr. Int. Strat. Geol. Carb. 5, Paris.* pp. 1171-1199	A taxonomic review of the striate disaccates of the Permian of the world.
	HART, G. F. '65b. *The systematics & distribution of Permian miospores.* Witwatersrand University Press, Johannesburg, pp. 1-252.	A taxonomic review of the miospores of the Permian of the world
	BHARADWAJ, D. C. (symp. '67) '69. Lower Gondwana formations. In: *Congr. Int. Strat. Geol. Carb. 6, Sheffield.* pp. 255-274.	(a) A brief review of the geographic & stratigraphic distribution of the miospores of the Permian of Gondwanaland. (b) Material is described from: 4 Parana Basin, I.
Daptocephalus to Lystrosaurus Zones	ANDERSON, H. M. & ANDERSON, J. M. '70. The biostratigraphy of the Permian & Triassic Part 1. A preliminary review of the biostratigraphy of the uppermost Permian, Triassic & Lowermost Jurassic of Gondwanaland. *Palaeont. afr.*, **13** (suppl.), 1-22.	A review of the stratigraphic distribution of miospores of the uppermost Permian in the Salt Range & Eastern Australia.
Full Permian Succession	HART, G. F. (symp. '67) '70a. The stratigraphic subdivisions & equivalents of the Karroo sequence as suggested by palynology. In: *I. U. G. S. Gondw. Symp. 1, Buenos Aires.* pp. 23-35.	A brief review of the geographic & stratigraphic distribution of the miospores of the Permian of gondwanaland.
	HART, G. F. (symp. '68) '70b. The biostratigraphy of Permian palynomorphs. In: *Am. Ass. Strat. Palynologists. Meet 1.*	A review of the geographic & stratigraphic distribution of the miospores of the Permian of the world, with particular reference to the U.S.S.R. and S. Africa.
Late Palaeozoic glacials (Dwyka)	KEMP, E. M. (symp. '73) in press. The palynology of Late Palaeozoic glacial deposits of Gondwanaland. In: *I. U. G. S. Gondw. Symp. 3, Canberra.*	(a) A review of the geographic & stratigraphic distribution of the miospores of the Late Palaeozoic glacial deposits of Gondwanaland. (b) Material is described from: 4 Parana Basin, F, G. 12. Salt Range, A. 22. Tr. Antarctic Mts., C.
Full Permian Succession	ANDERSON, J. M. This paper *Biostratigraphic palynology of the Permian sediments of the northern part of the Karroo Basin, South Africa.*	(a) A review of the taxonomy and of the geographic & stratigraphic distribution of the miospores of the Permian of Gondwanaland. (b) Material is described from: 9. Karroo Basin, D, E, F, G, H, I, J, K.

9.5 PHOTOGRAPHIC CATALOGUE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ANK

CHART

Key 15 - representative population of 15 specimens
•15 - reference population of 15 specimens
15+ - population illustrated by 15 figures but with significantly more than that number of specimens
13,2 - The two (or three) figures represent portions of populations from different sub-assemblages in cases where these are illustrated separately
| Single lines (together often with double lines) bracket populations comprising morphological continuums
|| Double lines bracket split populations of a compound population
Broken lines simply link separate portions of morphological continuums

TABLE of POPULATIONS & THEIR RELATIONSHIPS

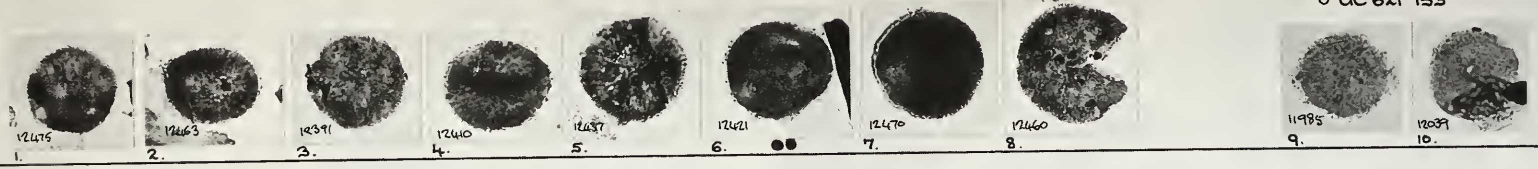
(INCLUDES ALL POPULATIONS in the PHOTOGRAPHIC CATALOGUE)

	Species / Assemblages	1 UC 608 1590'	2 UC 729 550,0 etc.	3 UC 608 1262'	4 SAP6 1151'3" etc	5 P13 152,95 etc	6 SAP6 1130' etc	7 P13 146,80 etc.	8 OW 1257'	9 WV3 133,50	10 P13 126,50 etc	11 OW 1171'	12 HKs	13 OW 1145' etc	14 UC 678 78,9 etc	15 UC 621 153'	16 SAP6 1000' etc	17 UC 678 30,6 etc	18 SAP6 521'	19 SAP7 464'	20 SAP7 338'	21 OW 312'	22 OW 170'	23 OW 94'	24 KD
1	Mehlisphaeridium parvum															2		•8							
2	" regulare									5					•10	5									
3	" irregulare						•22																		
4	" fibratum														2			2							
5	" gondwanensis						•13			21			7			3									
6	Maculatasporites eraduensis						•8																		
7	" indicus						•11,9																		
8	" minimus				•4																				
9	Circulisporites venosus						7									2		5							
10	" bianularis												•13												
11	" parvus							3			4	•9		1											
12	Pilasporites sciesus				•11							13													
13	" calculus				•12		27																		
14	Tetraporina simplex						4						•7+												
15	" tetragona						3																		
16	" superba						2						•14												
17	Quadrisporites horridus												3												
18	Micrhystridium karrooense										•34														
19	Zinjisporites congoensis									8			•50+												
20	" spinosus			•151																					
21	Gondisporites punctatus				•22											18									
22	" parvus				•41								49												
23	" echinatus												•15+												
24	" raniganjensis				18+		22,11			16+						•32		21							
25	" braziliensis						29									•27									
26	" congoensis						•27																		
27	" lacunatus															•5+		3							
28	" regularis				•7+																				
29	" variabilis									•149															
30	" splendens						133			•117															
31	Acanthotriletes (levigate)																								
32	" (granulate)																								14
33	" (spinate)			52			154						110												18
34	" (baculate/pilate)																								
35	" (branching baculae)																								
36	Microbaculispora labyrinthica																		3		•5				
37	" microreticulata						•23																		
38	" virkkiae				•24		12									2		2							
39	" plicata						8,8									3		•5							
40	" directa						18											•7							
41	" tentula		6				•32						19												
42	" finegranulata					•9																			
43	" mediogranulata				•28																				
44	" grandegranulata		•6	2																					
45	" micronodosa			2	5		7						6					•15							
46	" trisina														12			•18							
47	" gondwanensis														12			•20							
48	" villosa																		1	1	•8				
49	" ericiana																		1	1	•4				
50	" eoericiana				•14																				
51	" pseudoreticulata				•16																				
52	" naumovae				5		•19																		
53	" pentagonalis						1								3	•3									
54	" irregularis												1	3	•9	5									
55	" plumsteadi				•17		8																		
56	" lageniformis						9		•6					1,1											
57	" paramicronodosa						•5		1					1				1							
58	" paratentula													•8,5,1	1	3		1							
59	" spinosa												•4	2,1		4		1							
60	" capilliformis															•4									
61	" digitiformis			•3																					
62	" sp. A.																	•1							
63	Gracilispora membranosa												•12												
64	Dulhuntyispora dulhuntyi																		1	•5	1				
65	Pachytriletes densus			•31																					
66	Punctatisporites gracilis	•24																							
67	" parvus			•7																					
68	" medius			2									•6												
69	" gretensis			13	3		•19,6																		
70	Paucipunctatosporites karrooensis						•11																		
71	Altitriletes densus									•15					10	6		10							
72	Cyclogranisporites intrareticulatus												5			8	•12								
73	" verrucosus						28						•47												
74	" parvus												•9												
75	" bhardwaji																							•44	9
76	Calamospora aplata																					3	6	•19	
77	" sinesignis																								•12
78	Inaperturosporites inapertus																							•19	
79	" vesiculatus																							•8	
80	Partimtactosporites verrucosus																							•38	
81	Apiculatisporis diversiformis						•10	6					2												
82	" minor						•10																		
83	" major						•7																		
84	" levis						•9																		
85	" bulliensis						4	5																	•12
86	" cornutus	2		3	4		•7						2												
87	Polypodiisporites detritus												•16					25							
88	" mutabilis																							•8	
89	Laevigatosporites vulgaris												•6												7
90	" striatus												•32	2											
91	" varistriatus												•7												
92	Vestigisporites ventrisaccatus														13		•27								
93	" rudis												•40												
94	" gracilis												•38												
95	" balmei												•181												
96	" neglectus												•28												
97	" walikalensis													•13	2										
98	" karharbarensis												•104											17	
99	" gondwanensis												•58		21										
100	" rotatus												•126	4	4										
101	Vittatina circumsaccata						•13																		
102	" multistriata				27		3						60	•41	10		34								
103	" nonsaccata													•12	7			1							
104	" simplex												4	2	•13										
105	" lucifera																							•93	54
106	" magna																							•43	8
107	" densa																							•39	
108	" fasciolata				•34										13										
109	" triradiata												•66		36										
110	Pityosporites nectus													9											
111	" triassicus													10										•19	
112	" nucleoparvus																							•52	
113	" indarraensis																								•15
114	" tenuicorpus												•78											52	9
115	" ovatus												•230												
116	" maximus												•58												
117	" levis												•46												
118	" fusus												•18												
119	" goraiensis																							•99	35
120	" cancellatus												•26												42
121	" amplus				8					5			•76	64										34	103
122	" micros																							25	•47
123	" varimicros																							•12	
124	Lueckisporites asulcus													5			19							•43	
125	" nyakapendensis													6	7	3	17							•30	
126	" welkomensis													5			•17								
127	" hannonicus															1	•9	2							
128	" neohannonicus																							•17	9
129	Cycadopites cymbatus		•9	1	10																				
130	Pinuspollenites thoracatus									•12															
131	Gnetaceaepollenites sinuosus												7		•14	5									
132	" ovatus													4	•6	3									
133	" bulbiger														1			•4			4				

Mehlisphaeridium parvum sp.nov.

● UC 678 31,6

o UC 621 153'

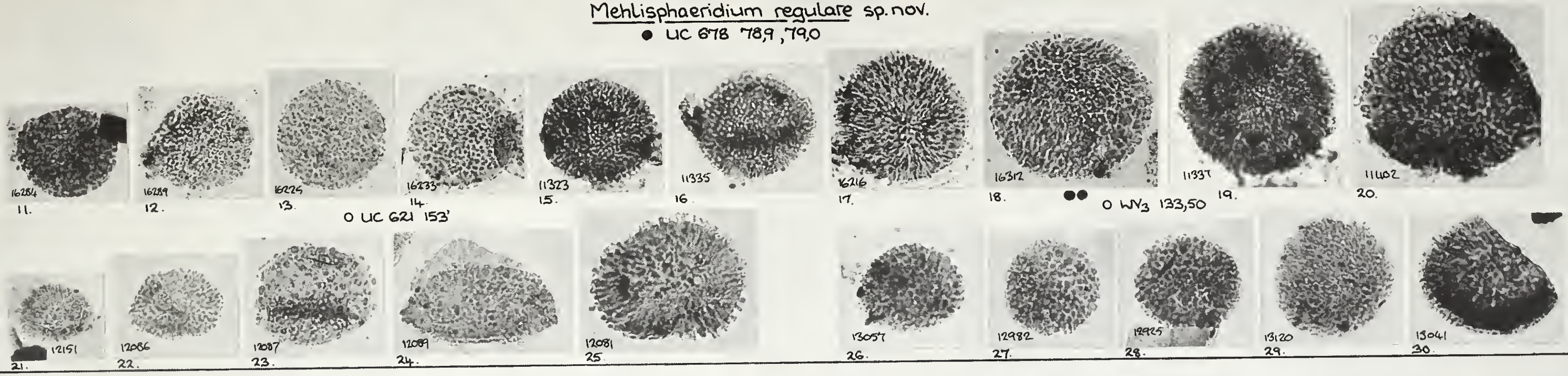


Mehlisphaeridium regulare sp.nov.

● UC 678 78,9 , 79,0

o UC 621 153'

o WV3 133,50



Mehlisphaeridium irregulare sp.nov.

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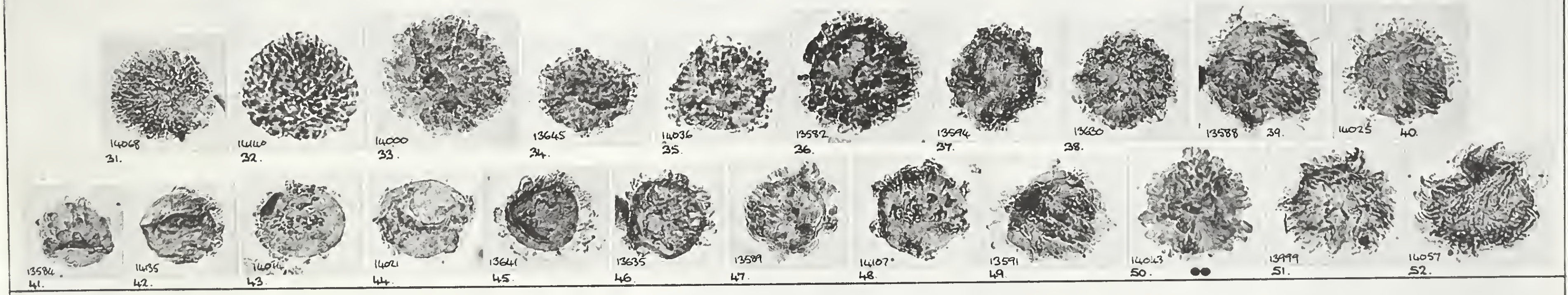
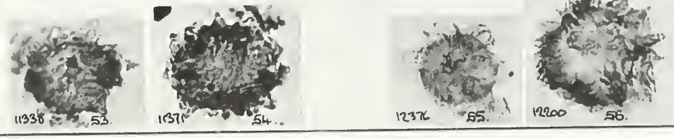


Mehlisphaeridium fibratum Segr. '67

o UC 678 78,9 , 79,3

o UC 678 30,6 , 31,6



Mehlisphaeridium gondwanensis (Tiw.'65) comb.nov.

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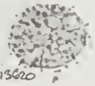
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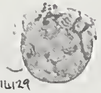
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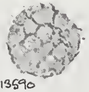
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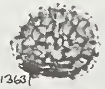
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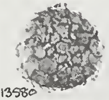
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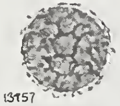
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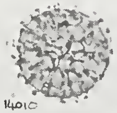
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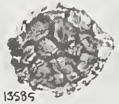
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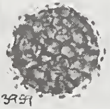
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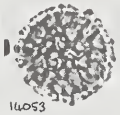
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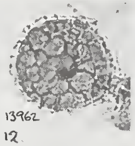
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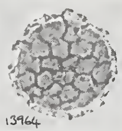
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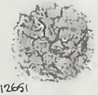
○ WV3 133,50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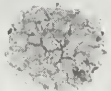
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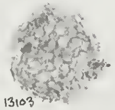
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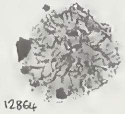
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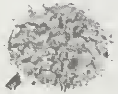
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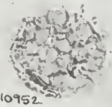
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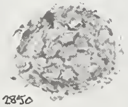
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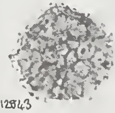
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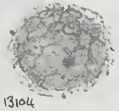
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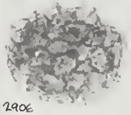
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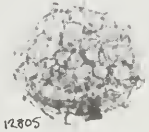
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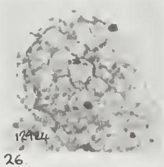
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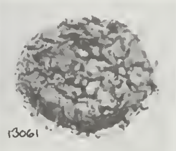
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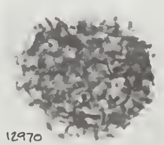
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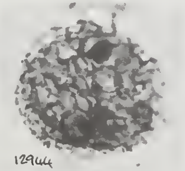
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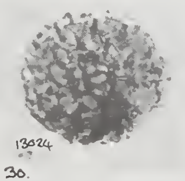
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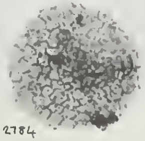
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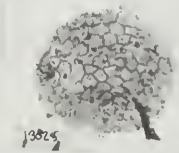
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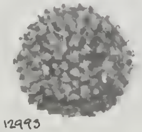
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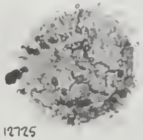
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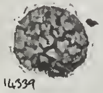
○ HKr.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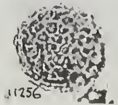
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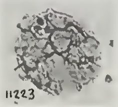
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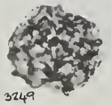
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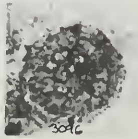
12520
39.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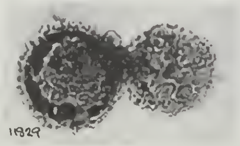
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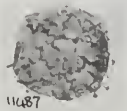
○ UC 621 153'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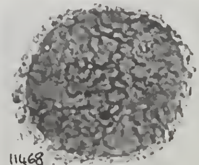
11945
43.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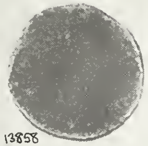
Maculatasporites eraduensis (Segr.'67) comb.nov.

● SAP 6 1133'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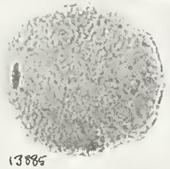
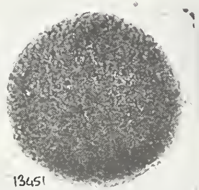
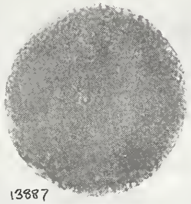

2. 13885


3. 13451 ●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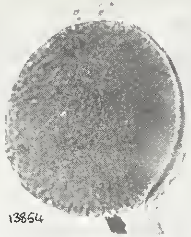
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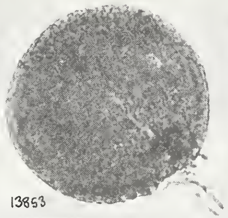
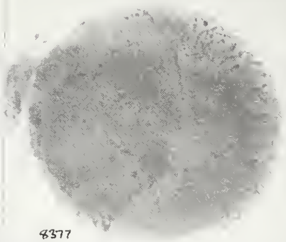
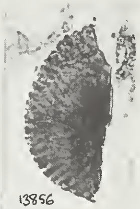
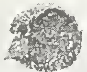

6. 13853

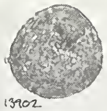

7. 8377


8. 13856

Maculatasporites indicus Tiw.'64

o SAP 6 1133'


9. 13559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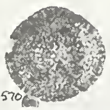
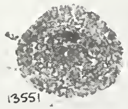
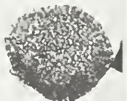

11. 13570


12. 13551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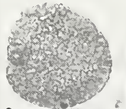
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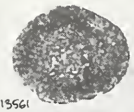
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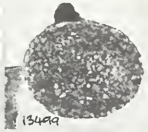
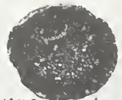
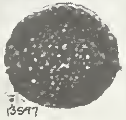

16. 13499


17. 13549

● SAP 6 1130'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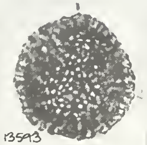
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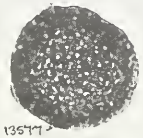
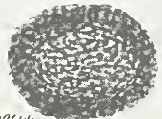
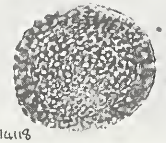
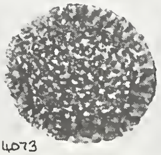
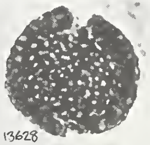
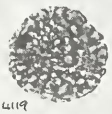

20. 13577 ●


21. 13644


22. 14118


23. 14073


24. 13628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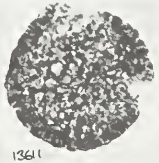
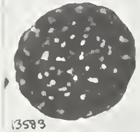
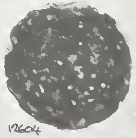
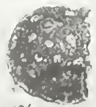

26. 13611

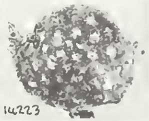

27. 13583

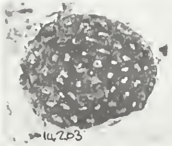

28. 12604

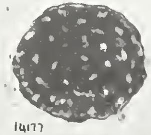
Maculatasporites minimus Segr.'67

● SAP 6 1152'9"


29. 14626

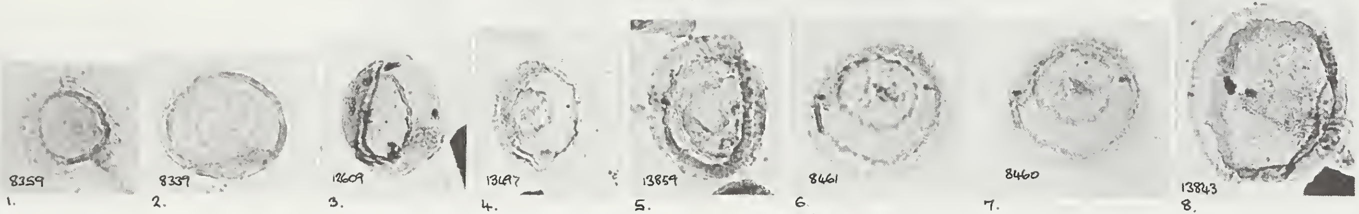

30. 14223


31. 14203

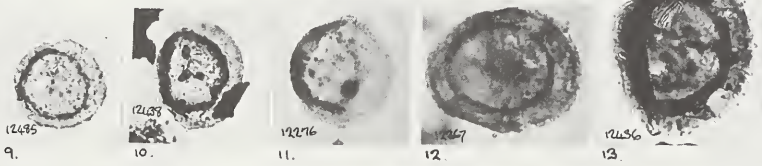

32. 14177 ●

Circulisporites venosus (Balme & Segr.'66) comb.nov.

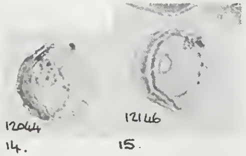
○ SAP 6 1130', 1133'



○ UC 678 30,6 , 31,6

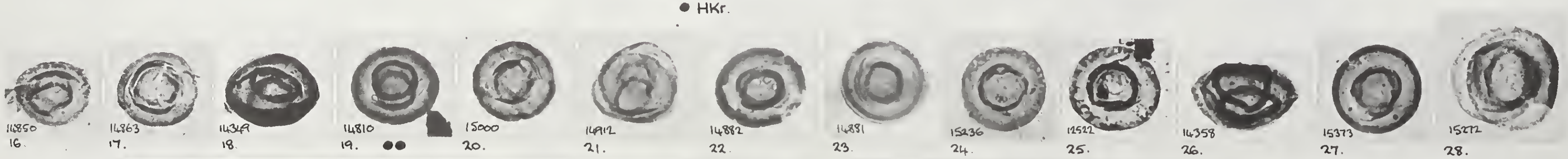


○ UC 621 153'



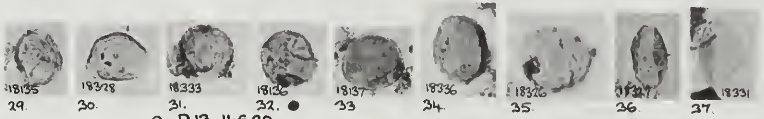
Circulisporites bianularis sp.nov.

● HKr.

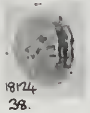


Circulisporites parvus de Jers.'62

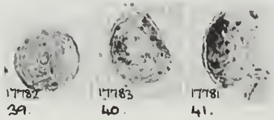
● OW 1171'



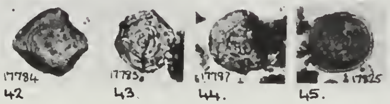
○ OW 1156'



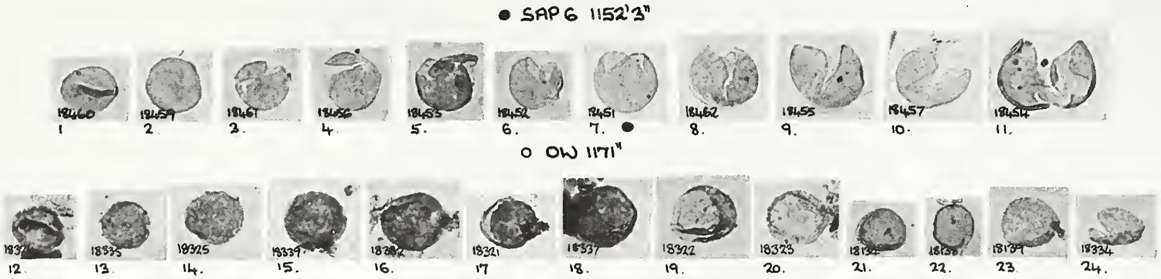
○ P13 146,80



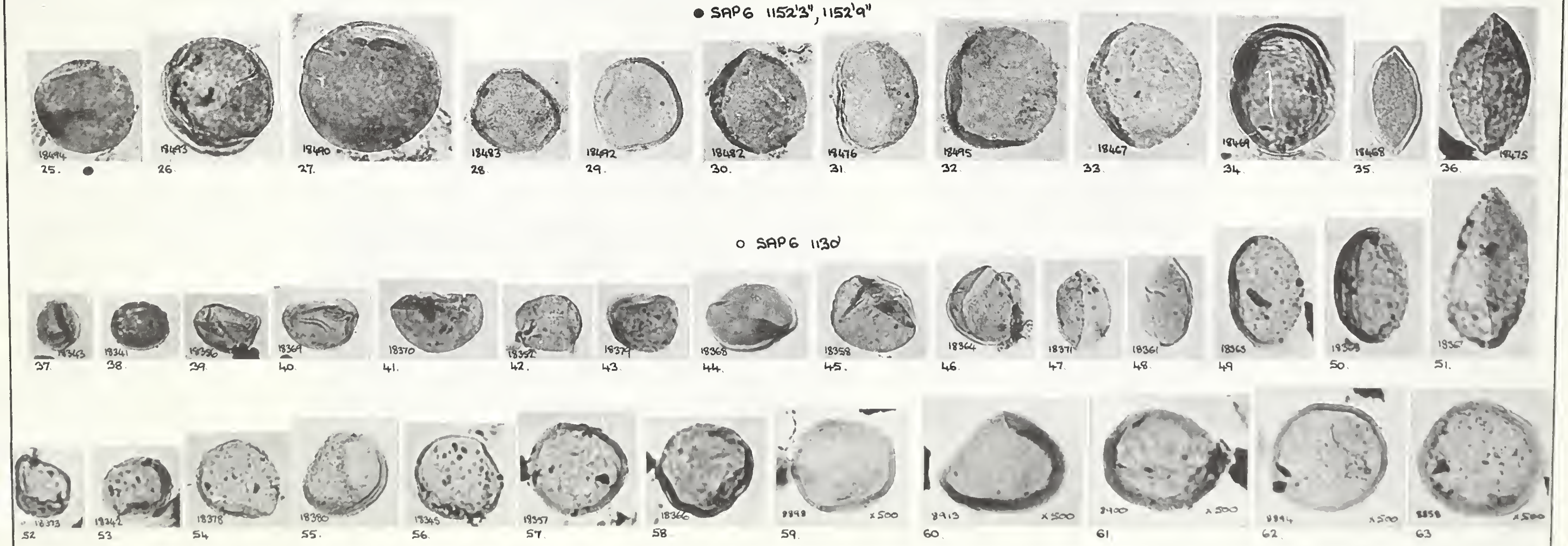
○ P13 126,50 , 128,13



Pilasporites scissus (Balme & Henn.'56) comb. nov.

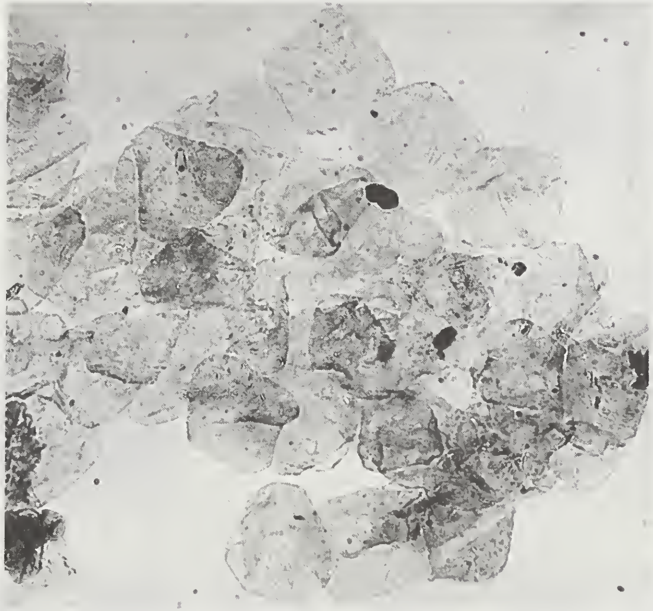


Pilasporites calculus Balme & Henn.'56



Tetraporina simplex sp. nov.

● HKr.



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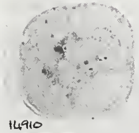

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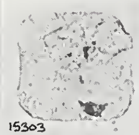

15303
3. ●●

14547
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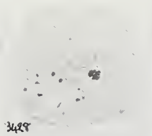

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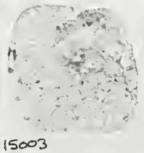

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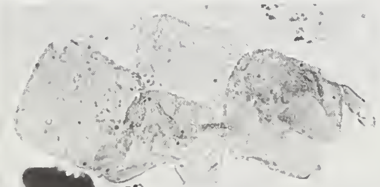

15286
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Tetraporina simplex sp. nov.

○ SAP 6 1133'

8380
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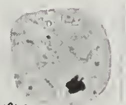


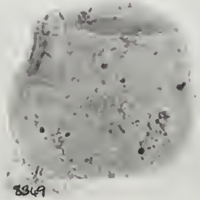
13494
9.

8507
10.

8395
11.

Tetraporina tetragona (Pant + Mehra '63) comb. nov.

● SAP 6 1133'



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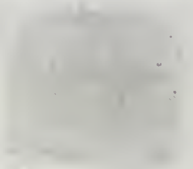

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13 ●

8308
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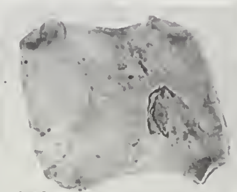
Tetraporina superba Mahesh. + Bose '69

○ SAP 6 1133'



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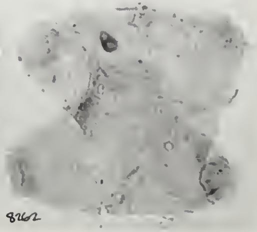

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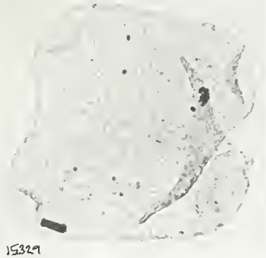
16.

Tetraporina superba Mahesh + Bose '69

● HKr.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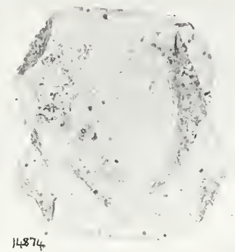
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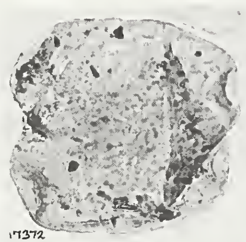
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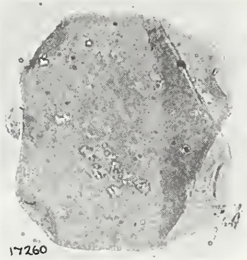
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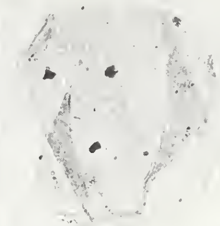
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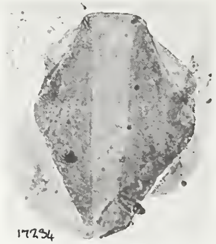
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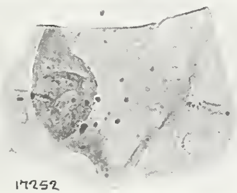
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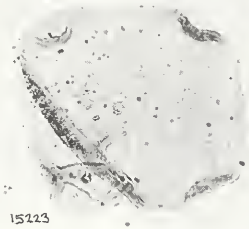
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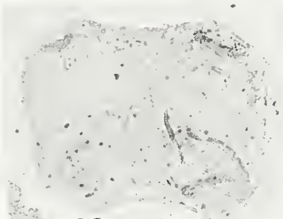
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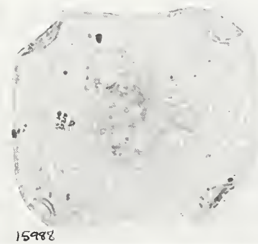
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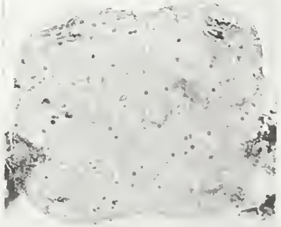
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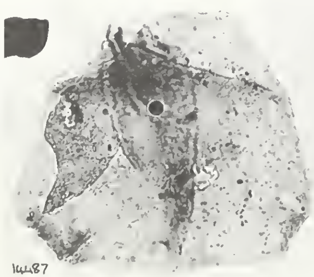
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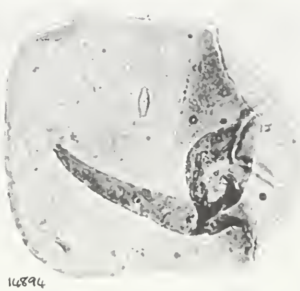
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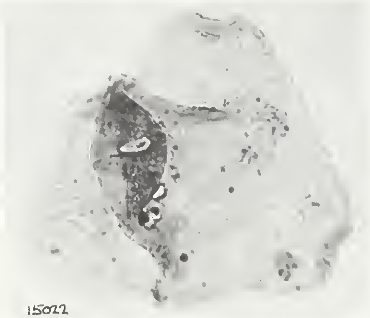
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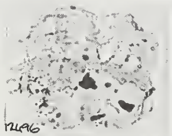
Quadrisporites horridus Henn.'58

○ HKr.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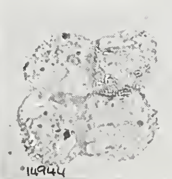
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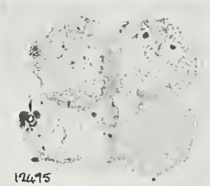
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3.

Micrhystridium karrooense sp. nov.

● P13 126,50 , 128,13

17807
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17818
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17822
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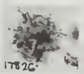
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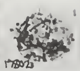
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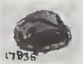
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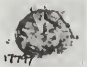
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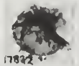
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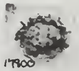
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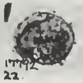
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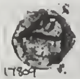
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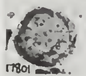
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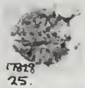
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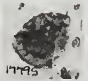
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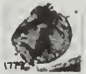
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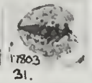
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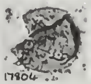
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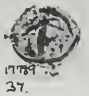
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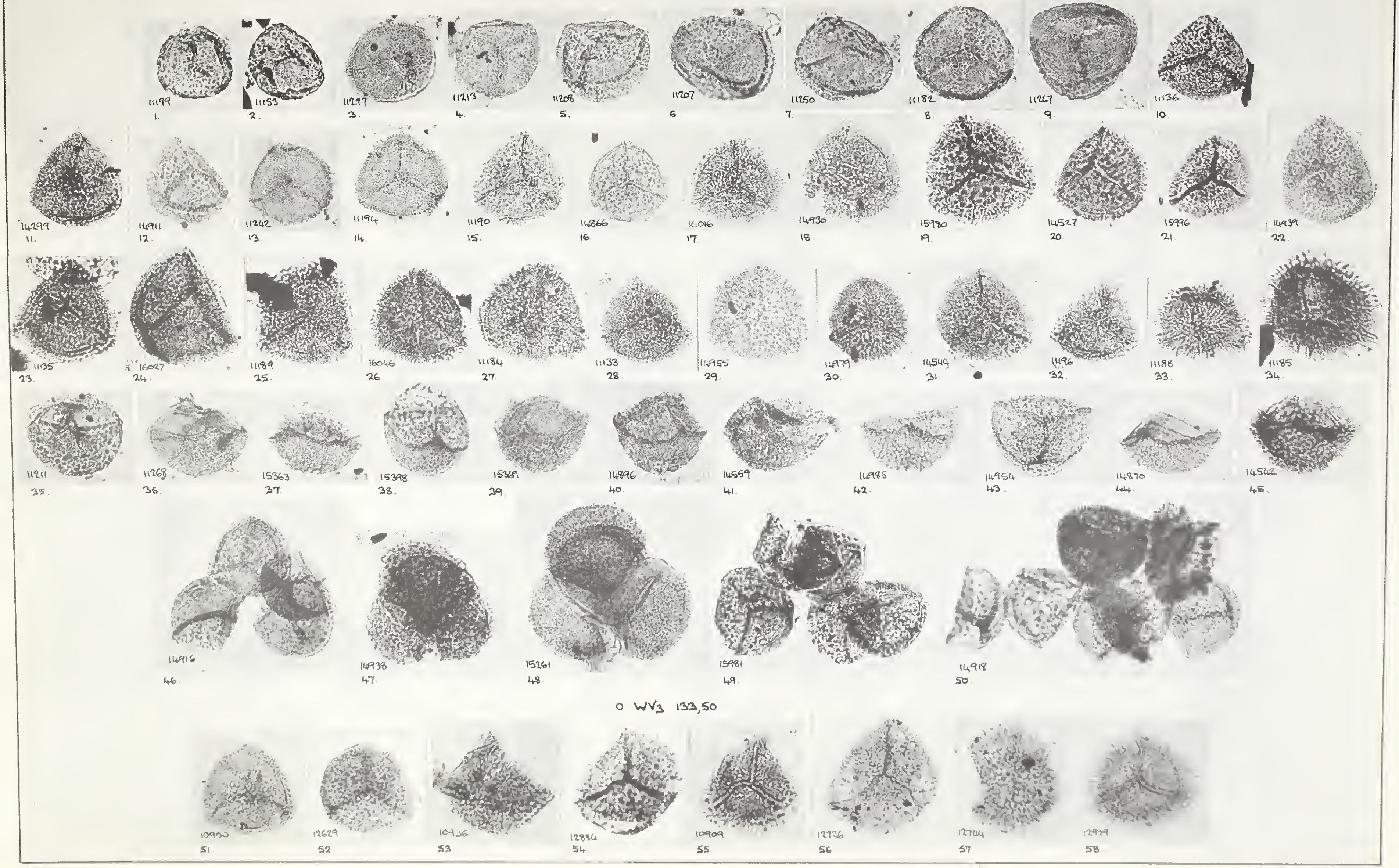
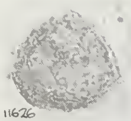
Zinjisporites congoensis (Mahesh. + Bose '69) comb. nov.

● HKr.



Zinjisporites spinosus (Kar & Bose '67) comb. nov.

● UC 608 1262'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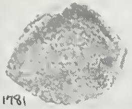
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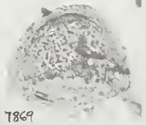
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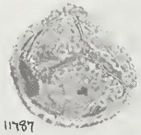
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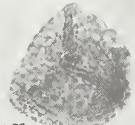
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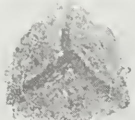
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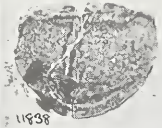
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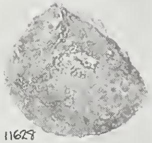
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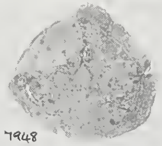
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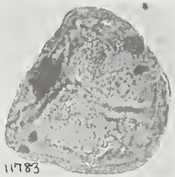
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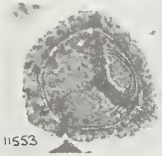
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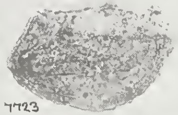
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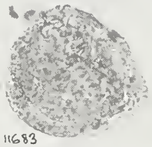
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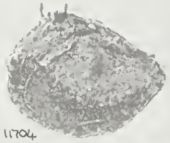
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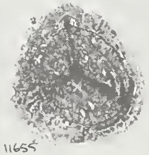
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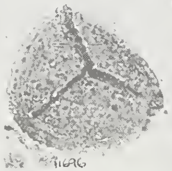
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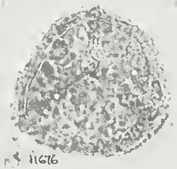
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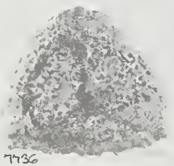
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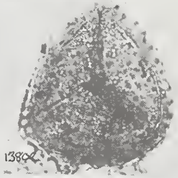
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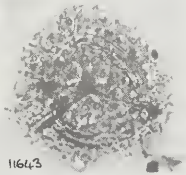
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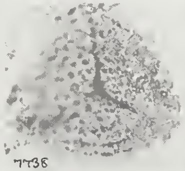
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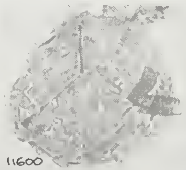
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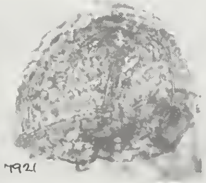
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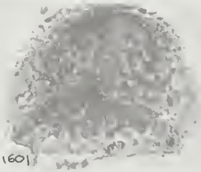
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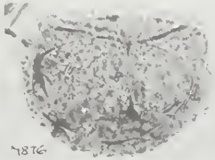
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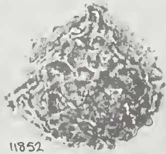
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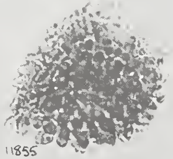
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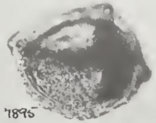
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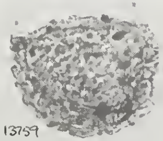
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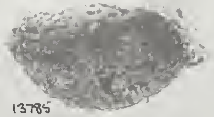
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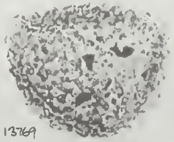
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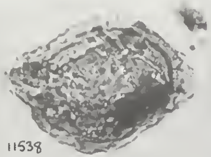
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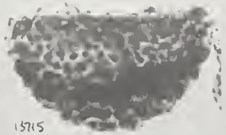
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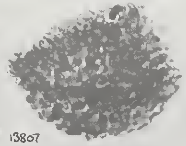
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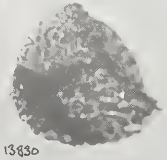
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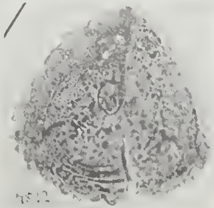
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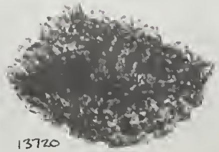
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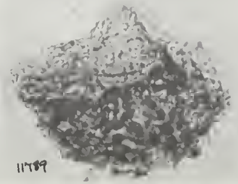
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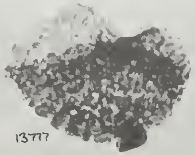
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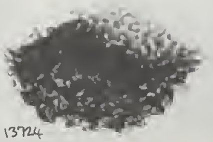
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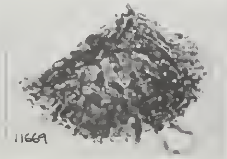
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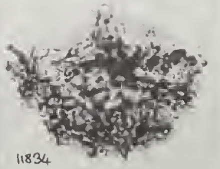
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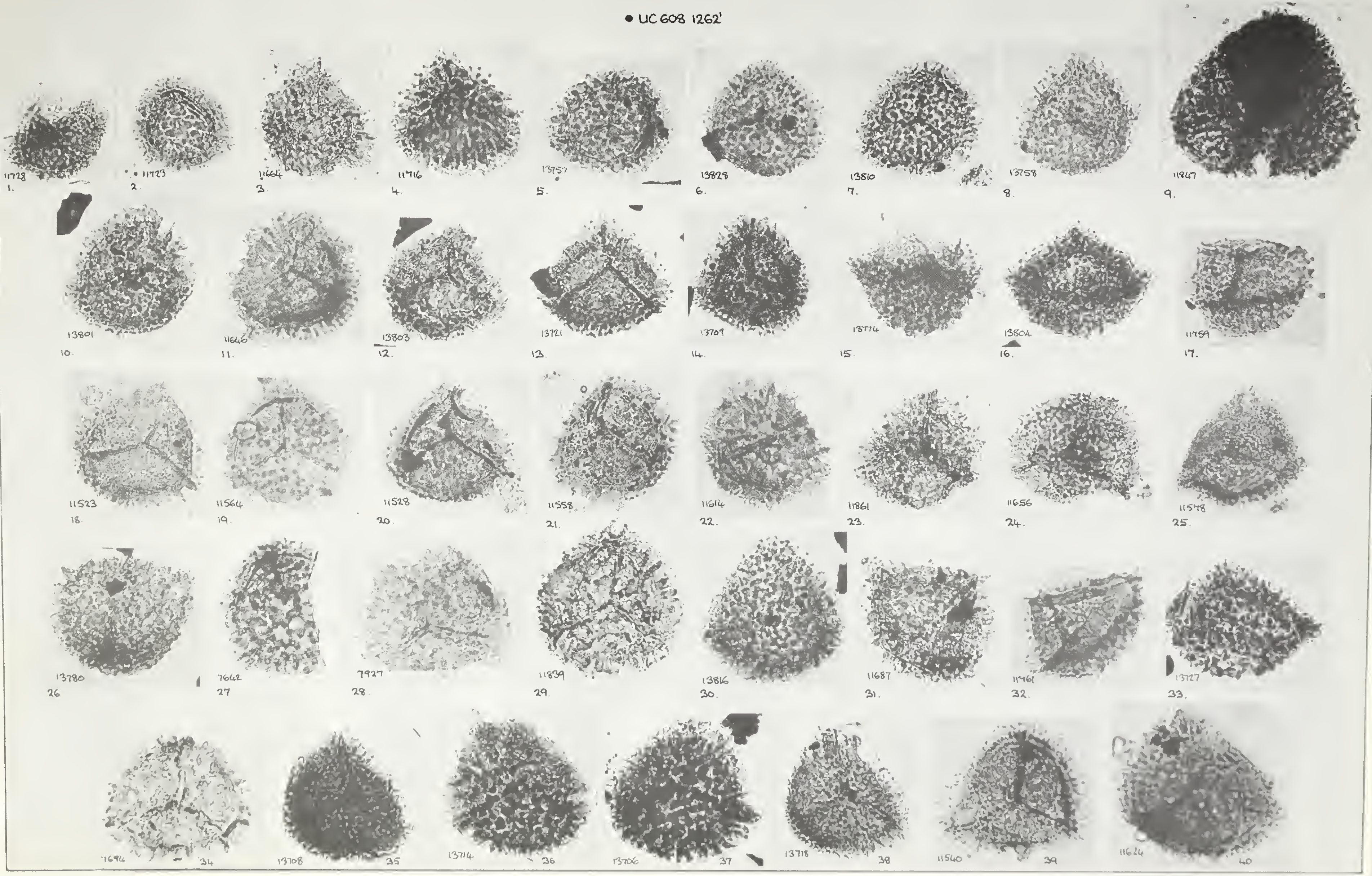
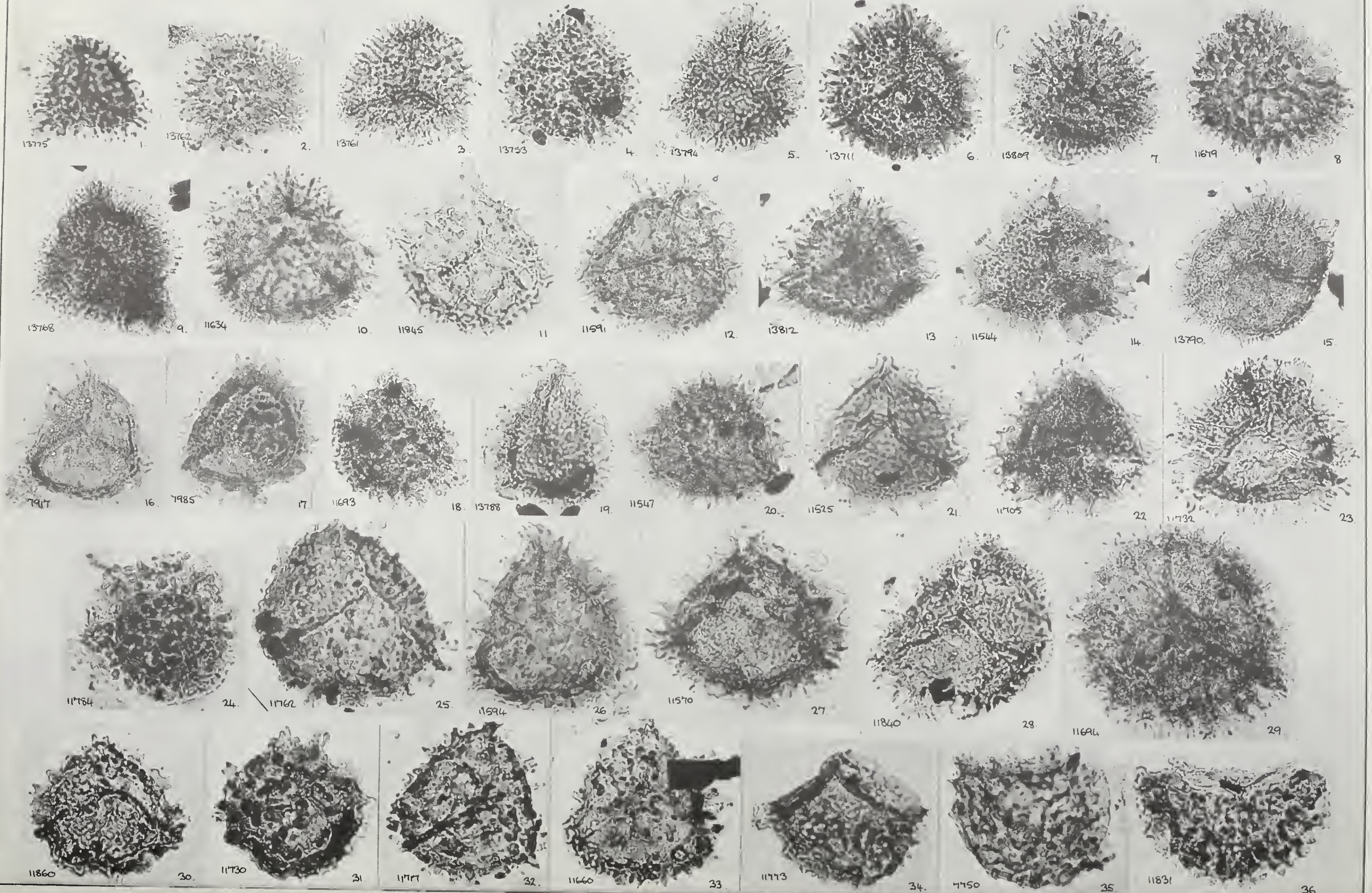
Zinjisporites spinosus (Kar & Bose '67) comb. nov.

• UC 608 1262'



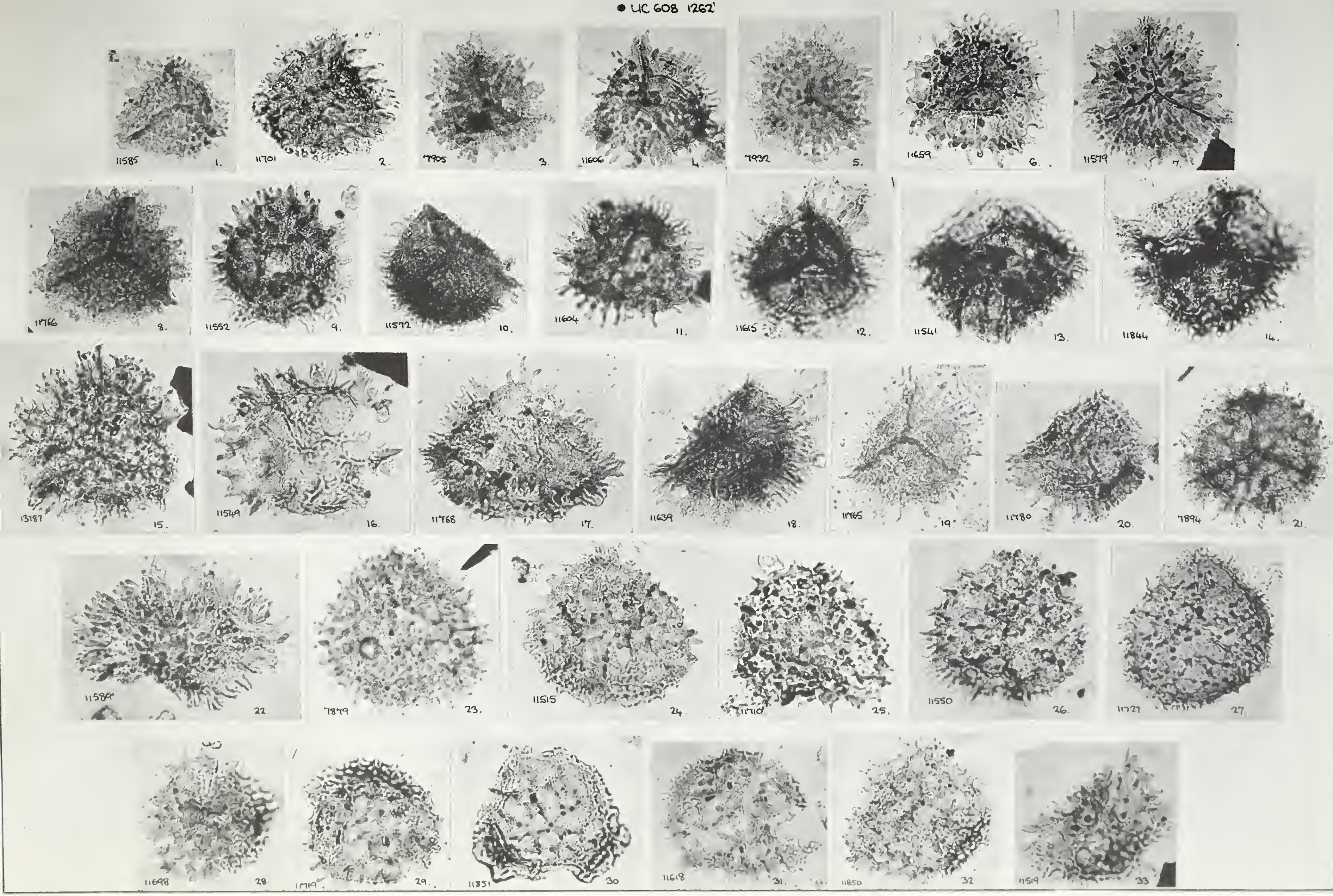
Zinjisporites spinosus (Kar+Bose '67) comb. nov.

● UC 608 1262'



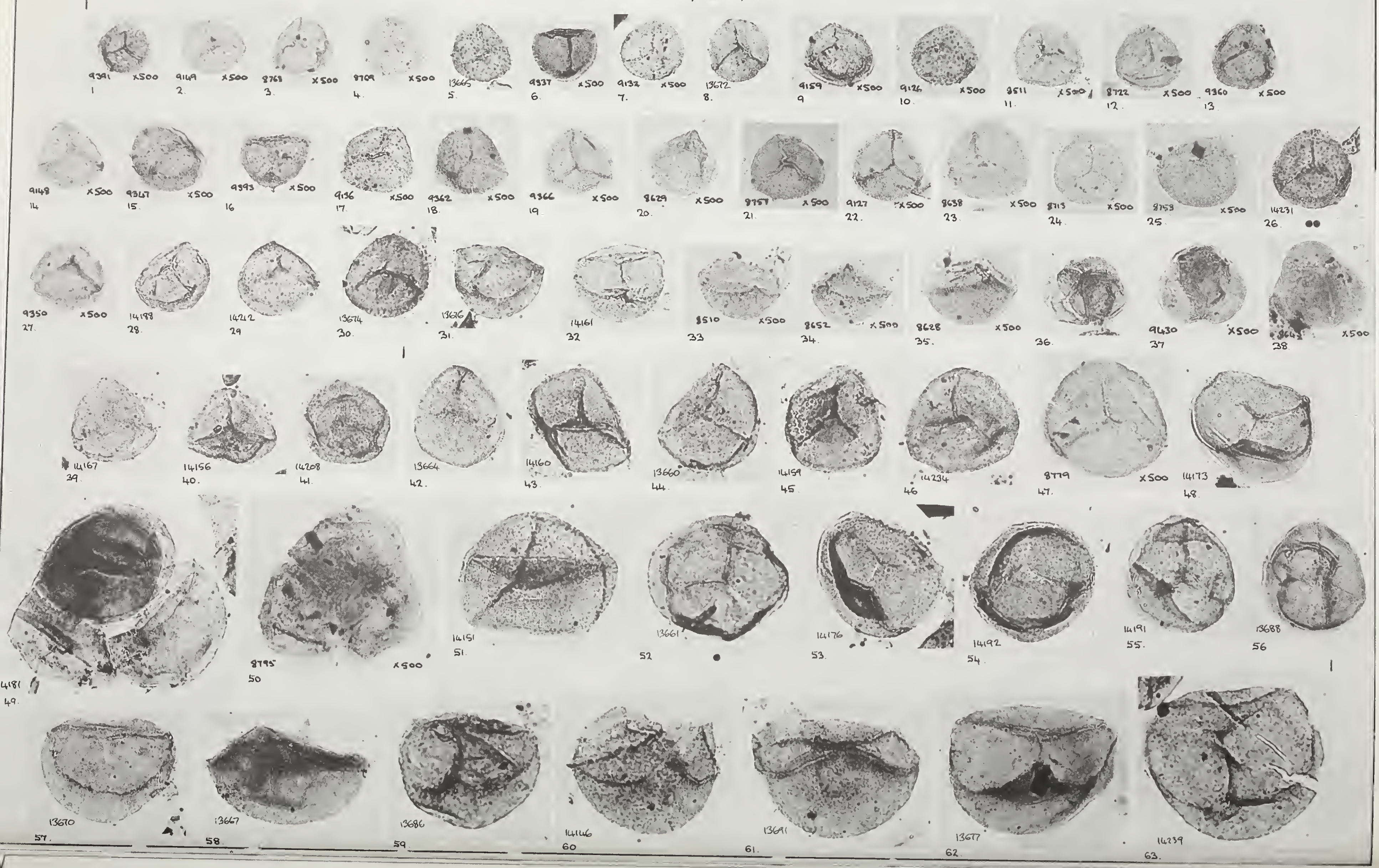
Zinjisporites spinosus (Kar + Bose '67) comb. nov.

● UC 608 1262'



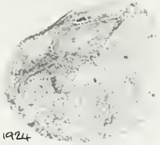
Gondisporites parvus sp.nov. / G. punctatus (Hart '63) comb.nov.
pl. 14 (1-41) pl. 14 (42-63)

●● SAP 6 1151'3", 1152'3", 1152'9"



Gondisporites punctatus (Hart '63) comb.nov.

o UC 621 153'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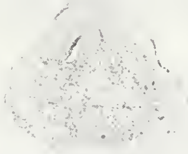
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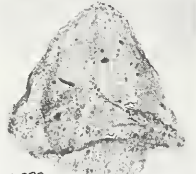
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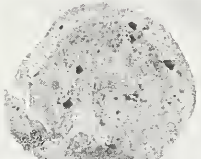
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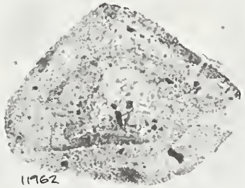
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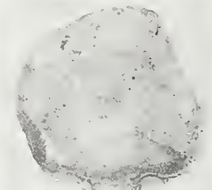
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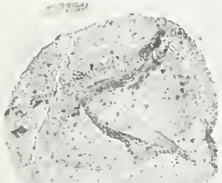
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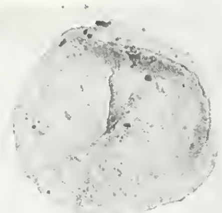
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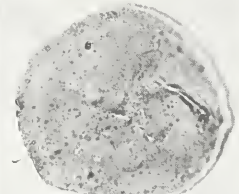
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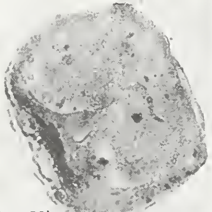
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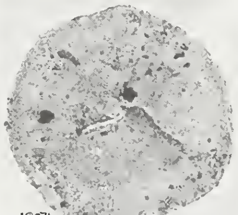
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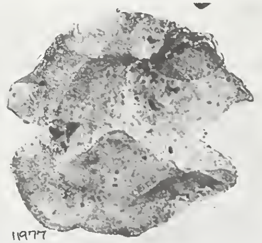
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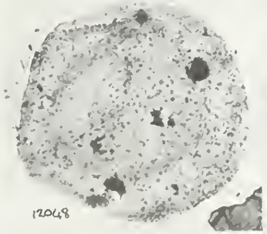
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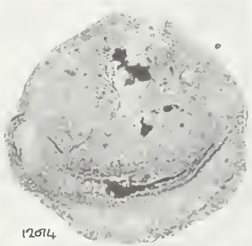
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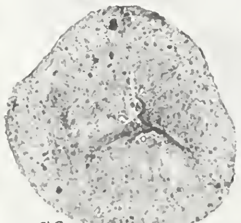
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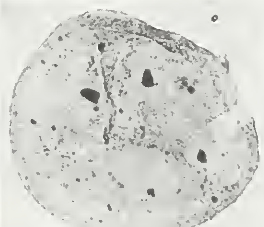
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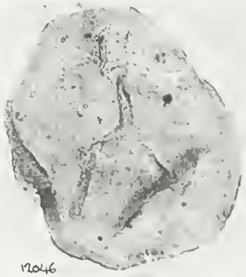
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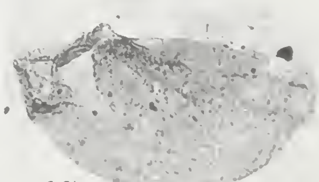
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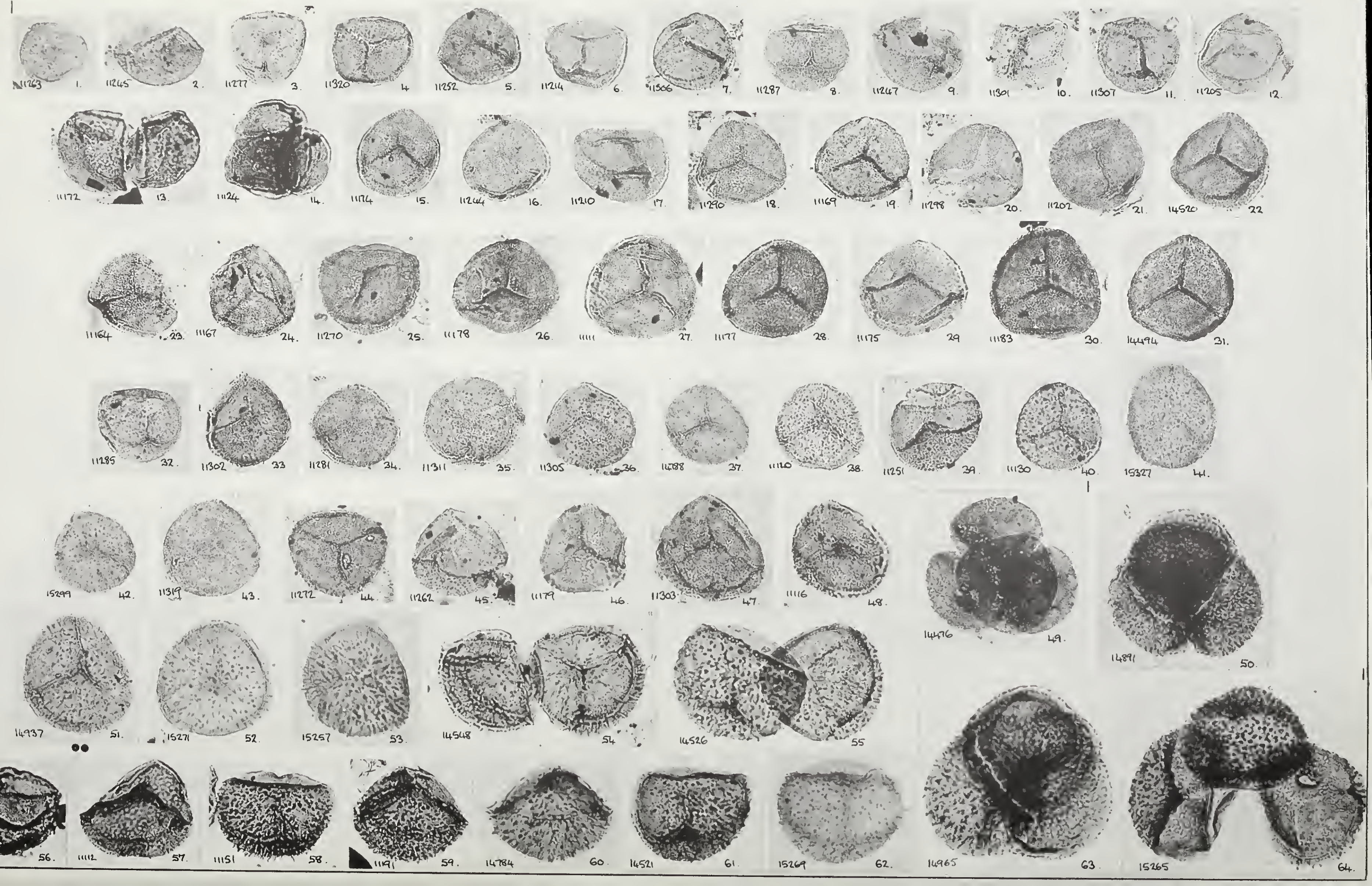
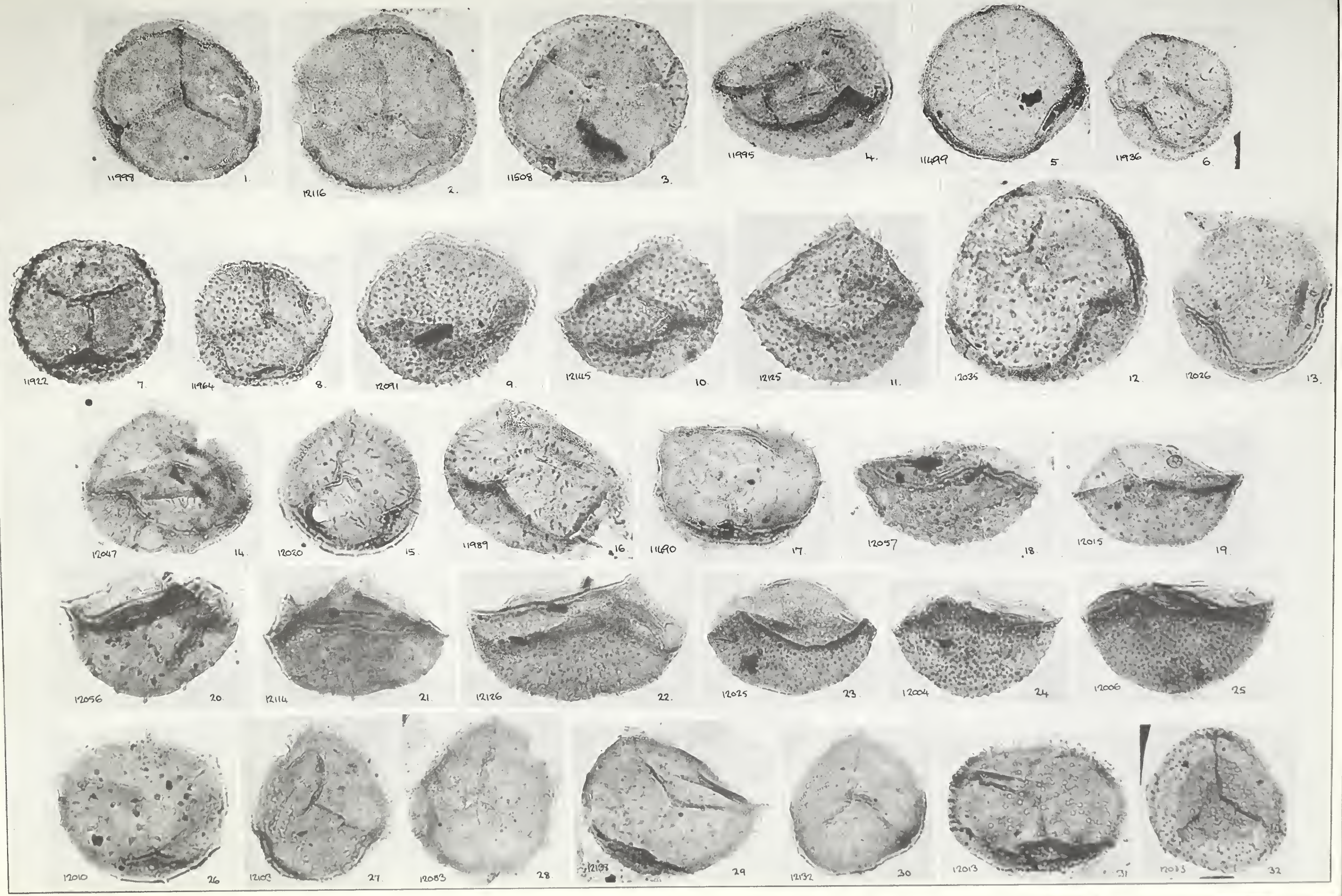
Gondisporites parvus sp.nov. / G. echinatus sp.nov.
pl 16(1-49) / pl.16(50-64)

○ ● HKr.



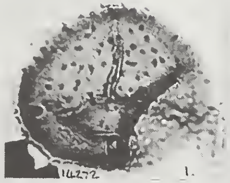
Gondisporites raniganjensis Bharad. '62

● UC 621 153'



Gondisporites raniganjensis Bharad. '62

o SAP 6 1131'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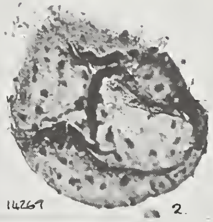
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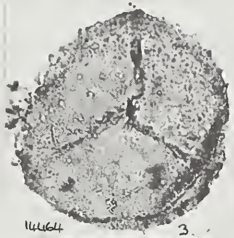
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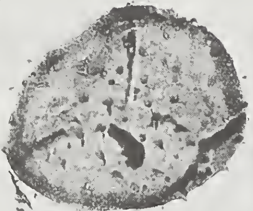
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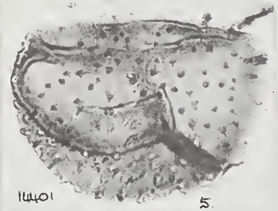
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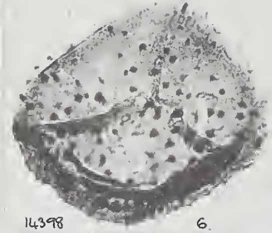
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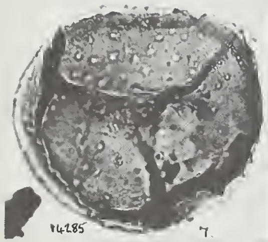
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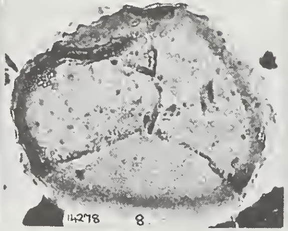
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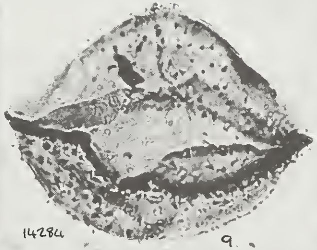
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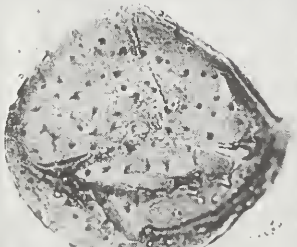
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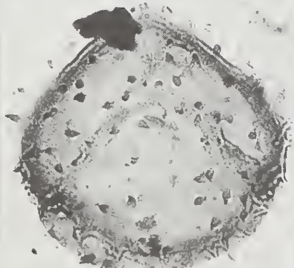
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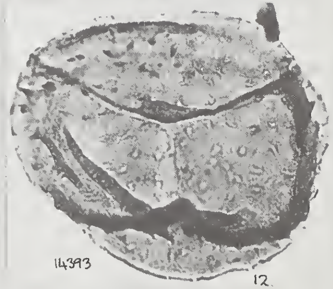
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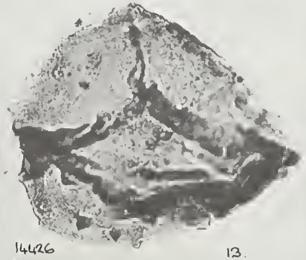
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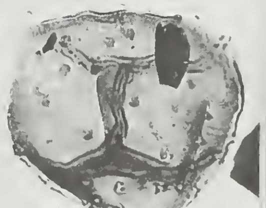
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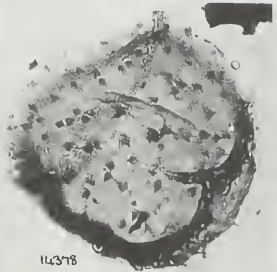
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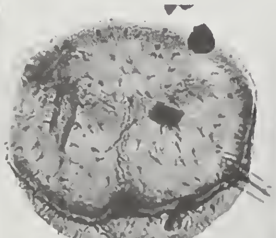
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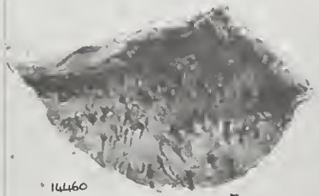
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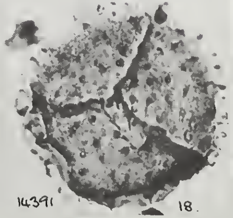
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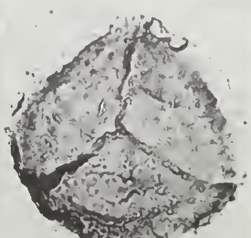
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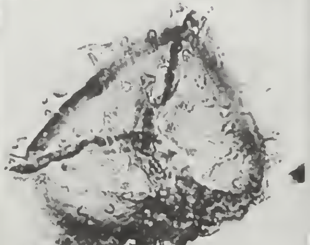
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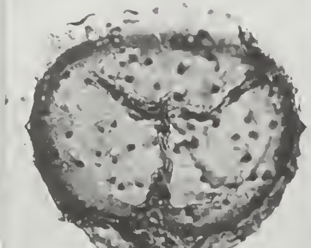
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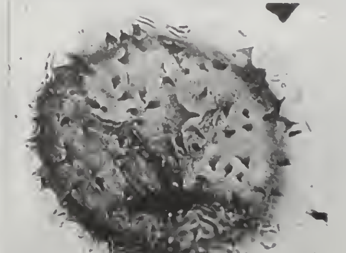
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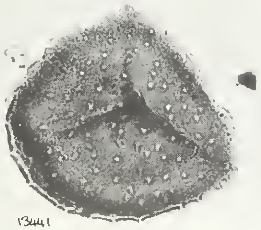
Gondisporites raniganjensis Bharad.'62

o SAP 6 1133'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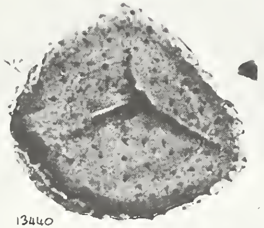
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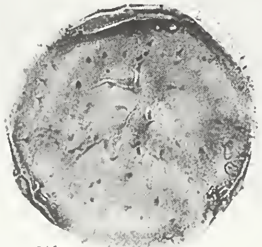
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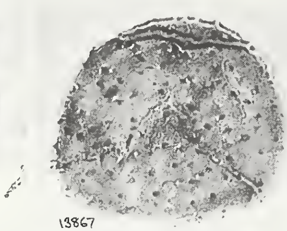
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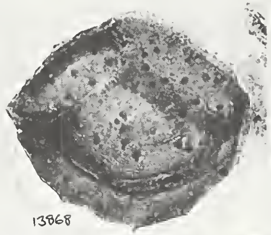
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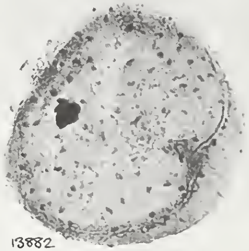
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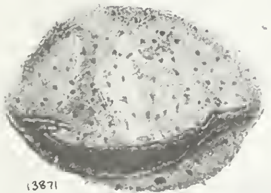
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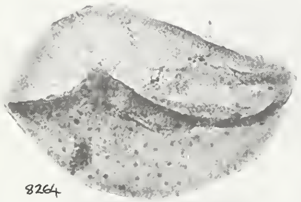
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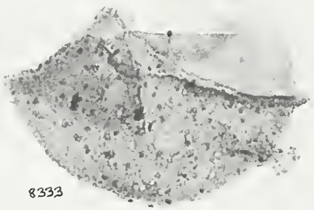
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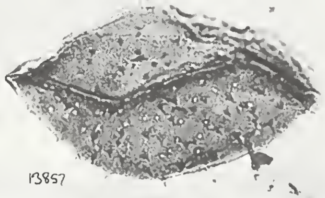
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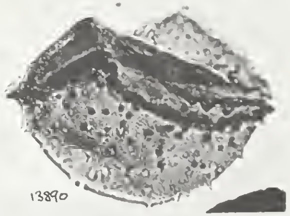
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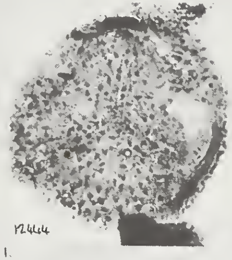
11.

Gondisporites raniganjensis Bharad. '62

o UC 678 30,6 , 31,6



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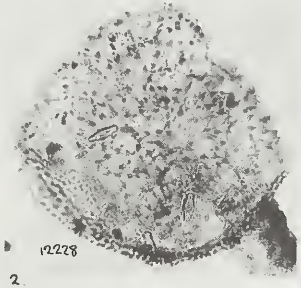

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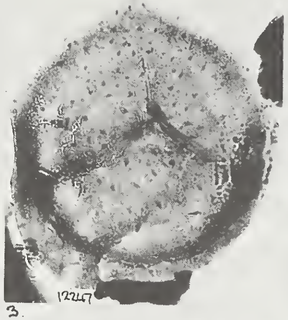

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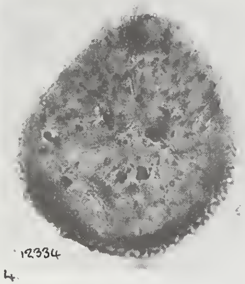

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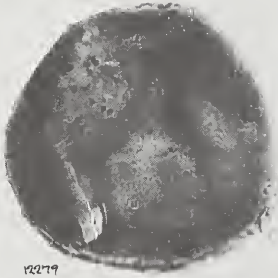

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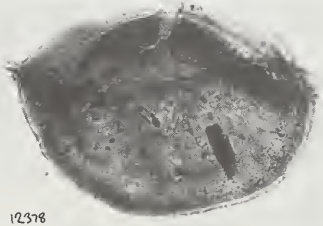

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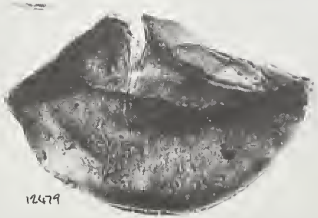

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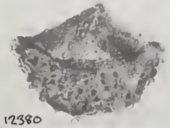

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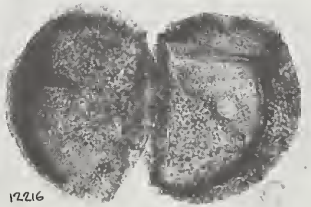

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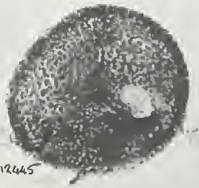

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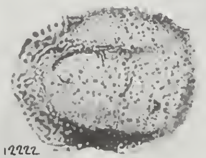

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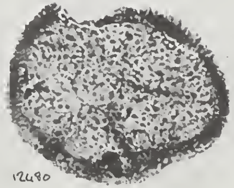

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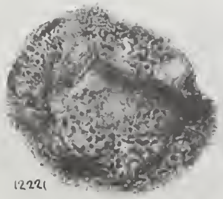

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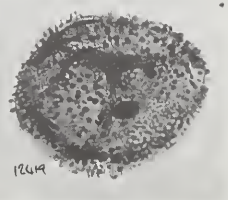

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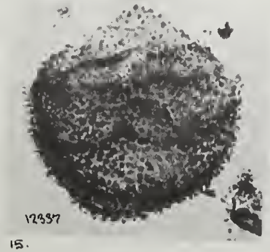

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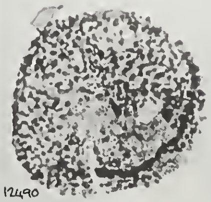

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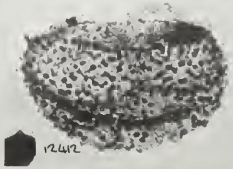

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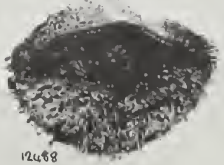

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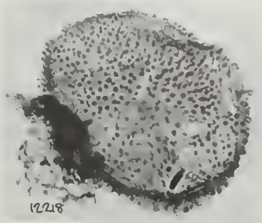

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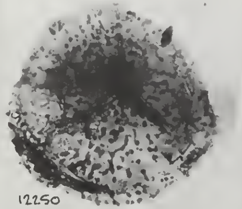

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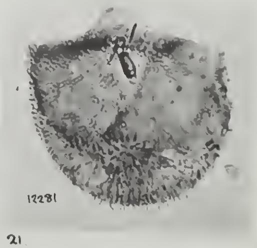

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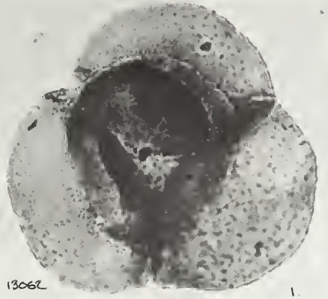
21.

Gondisporites raniganjensis Bharad.'62

o WV3 133,50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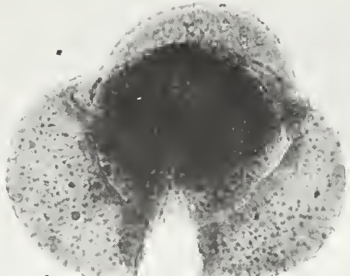
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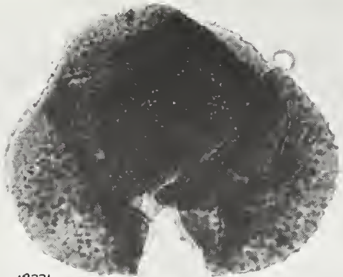
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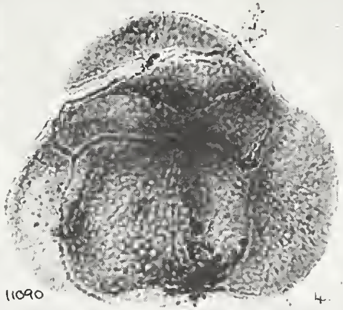
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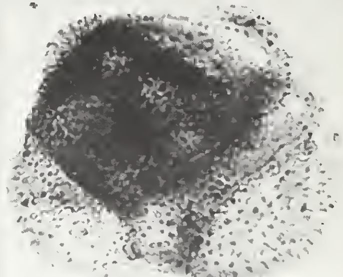
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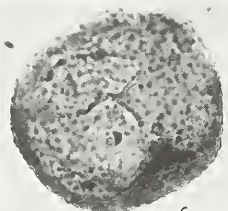
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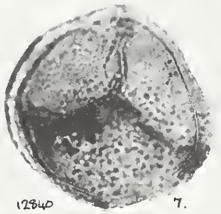
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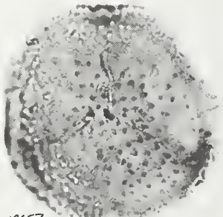
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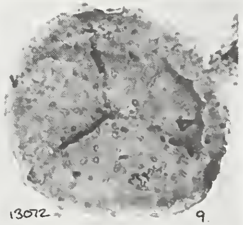
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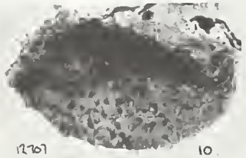
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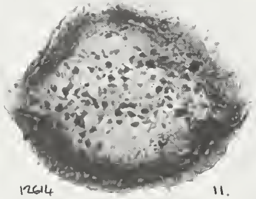
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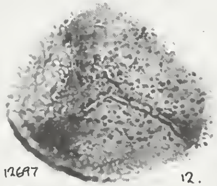
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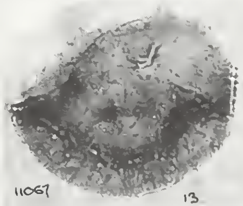
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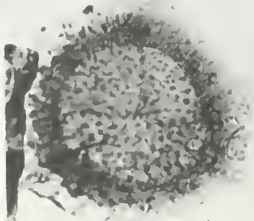
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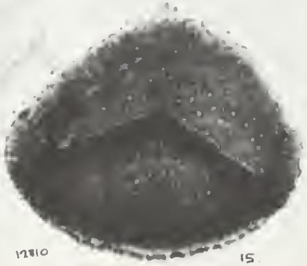
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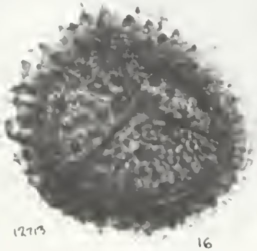
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Gondisporites raniganjensis Bharad. '62

o SAP 6 1151'3", 1152'3", 1152'9"

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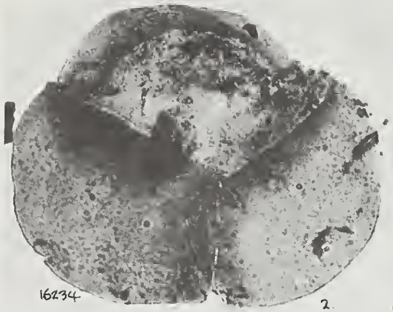
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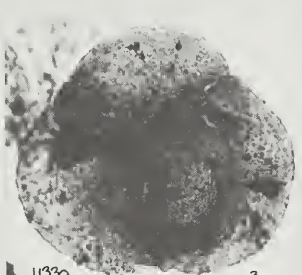
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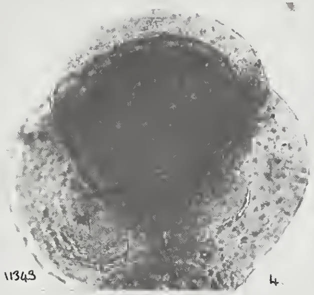
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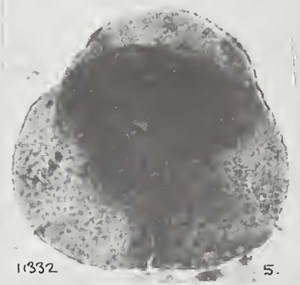
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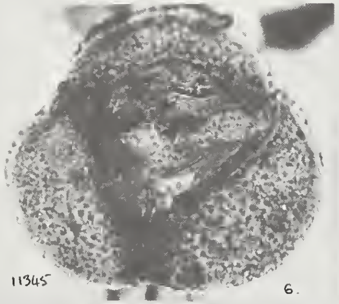
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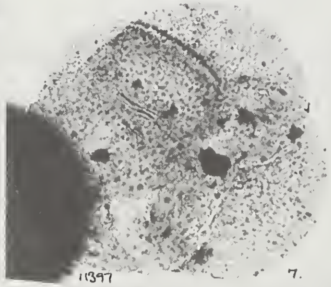
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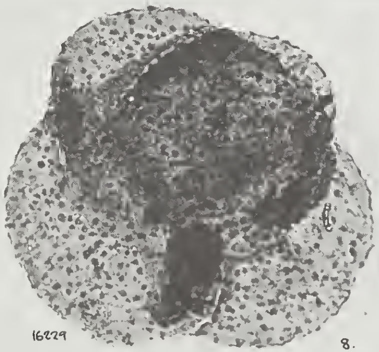
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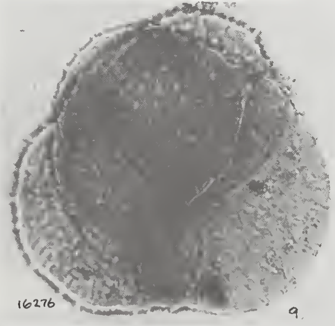
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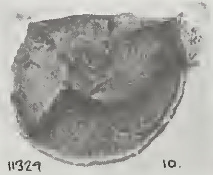
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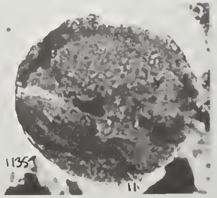
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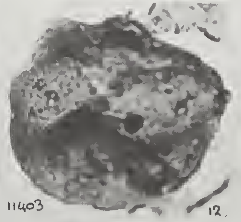
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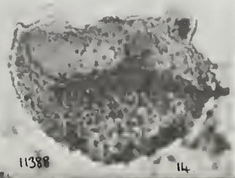
11379 13.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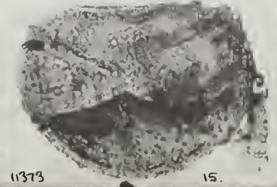
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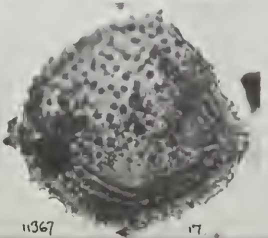
11399 16.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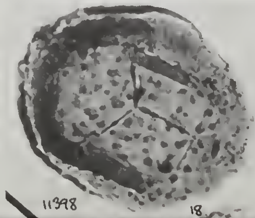
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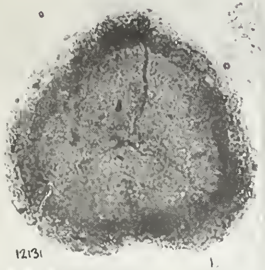
Gondisporites braziliensis (Pant + Sriv '65) comb. nov.

• UC 621 153'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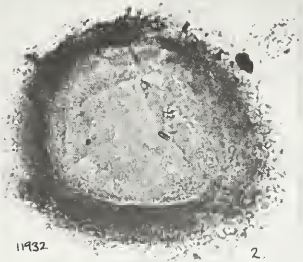
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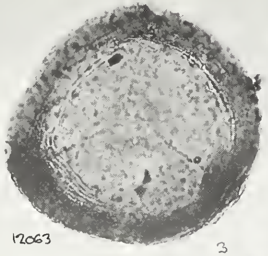
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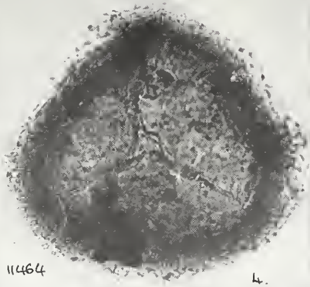
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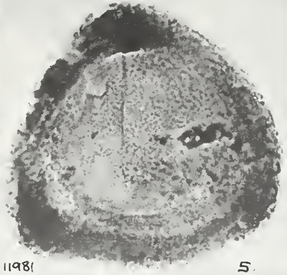
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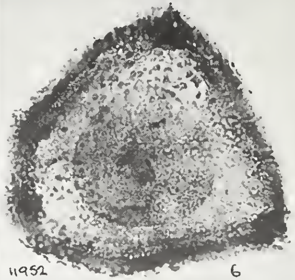
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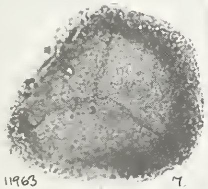
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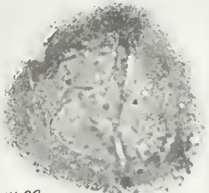
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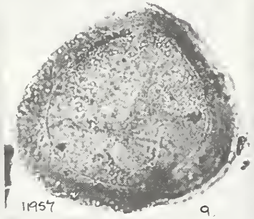
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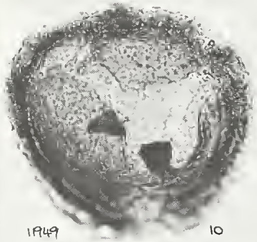
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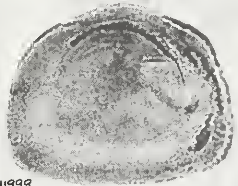
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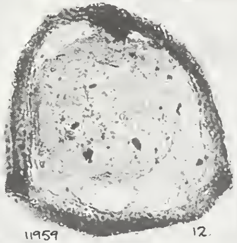
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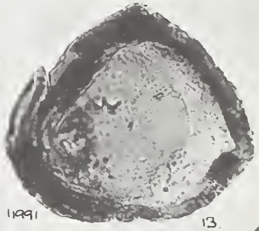
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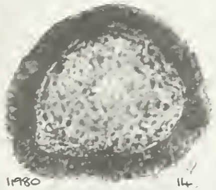
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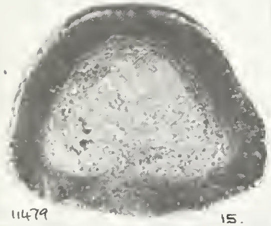
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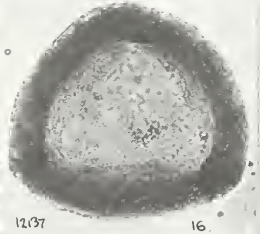
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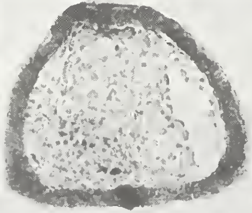
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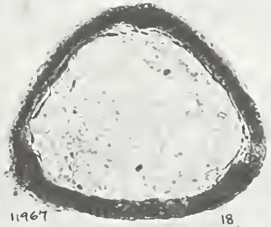
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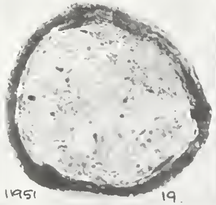
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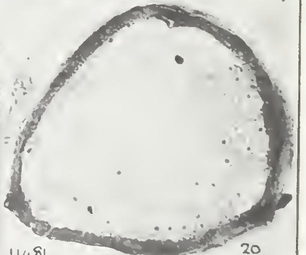
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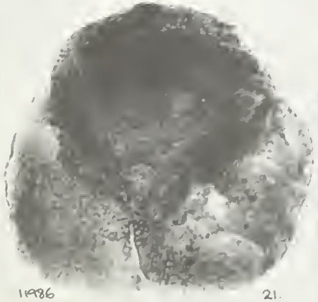
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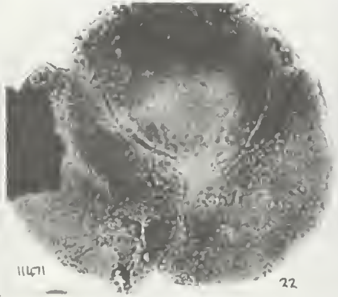
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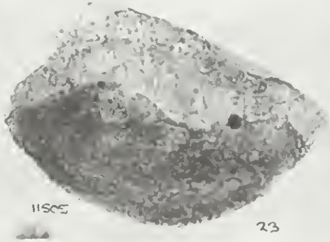
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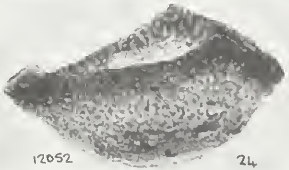
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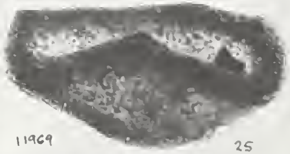
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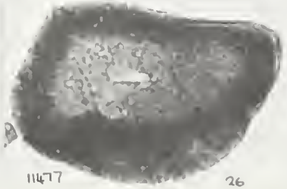
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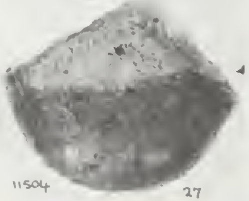
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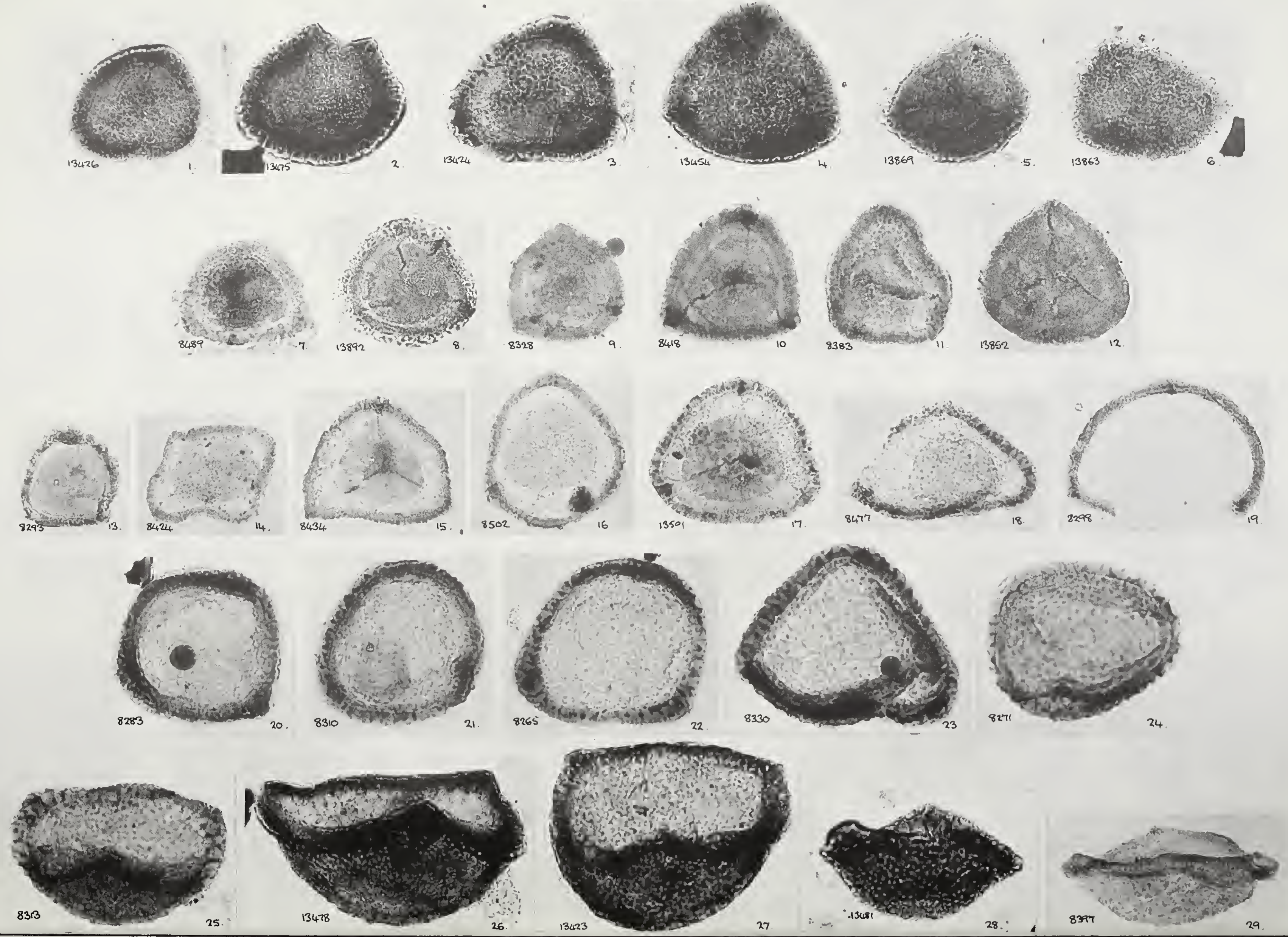
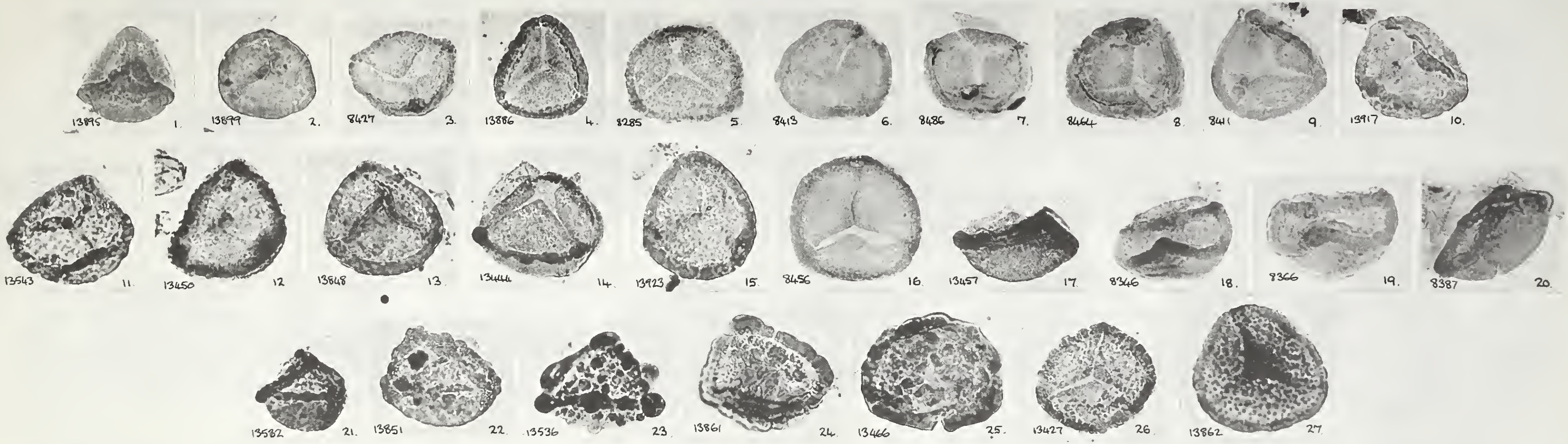
Gondisporites braziliensis (Pant + Sriv. '65) comb. nov.

0 SAP 6 1133'



Gondisporites congoensis (Mahesh. + Bose '69) comb. nov.

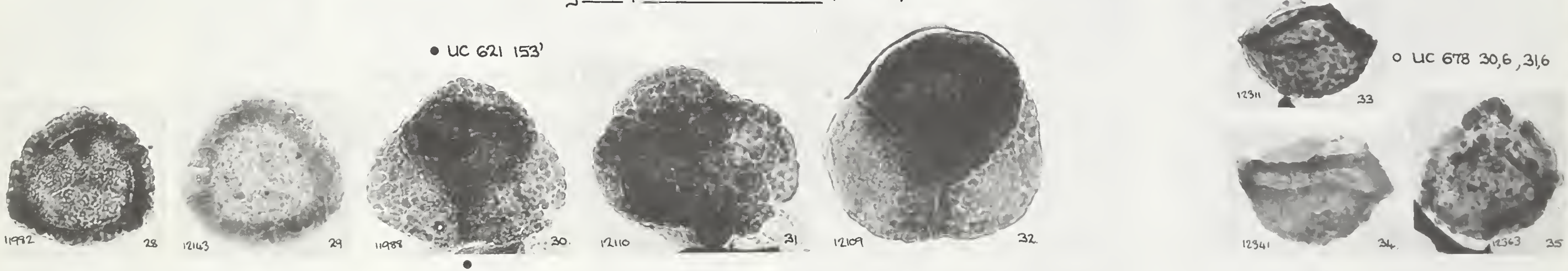
● SAP 6 1133'



Gondisporites lacunatus (Tiw. '65) comb. nov.

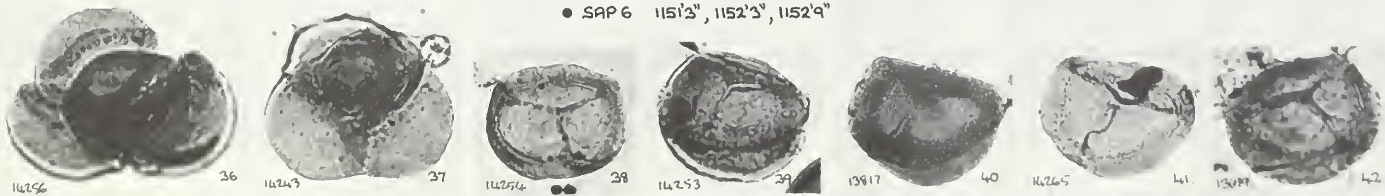
● UC 621 153'

○ UC 678 30,6 , 31,6



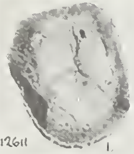
Gondisporites regularis sp. nov.

● SAP 6 1151'3", 1152'3", 1152'9"



Gondisporites variabilis sp.nov. / G. splendens (Balme & Henn.'56) comb.nov.
pl. 26-28 (in full) pl. 29-32 (in full)

: WV3 133,50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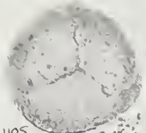
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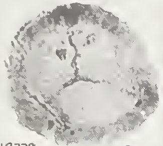
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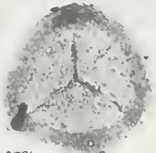
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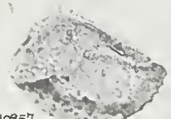
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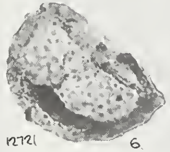
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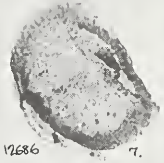
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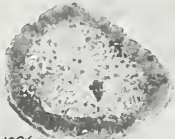
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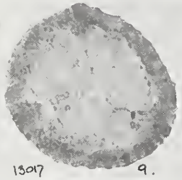
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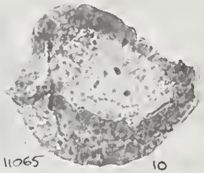
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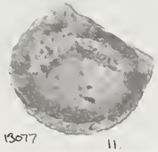
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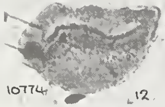
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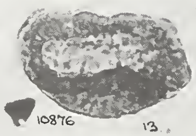
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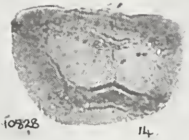
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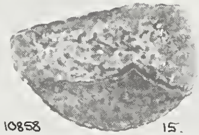
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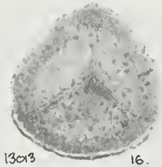
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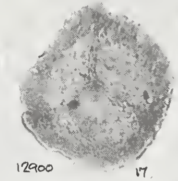
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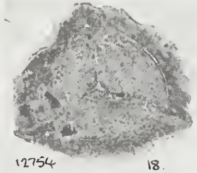
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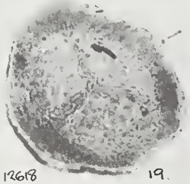
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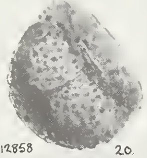
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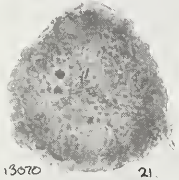
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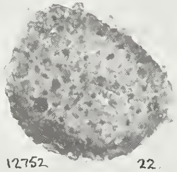
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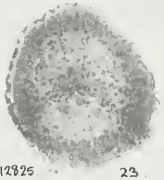
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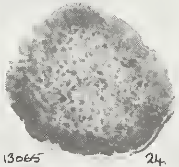
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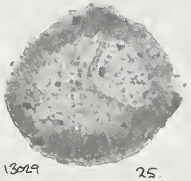
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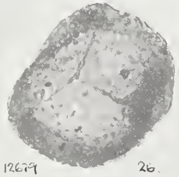
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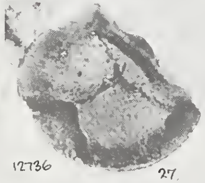
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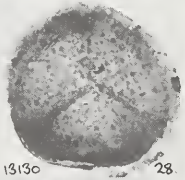
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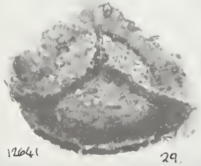
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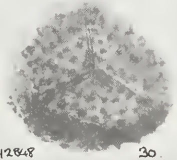
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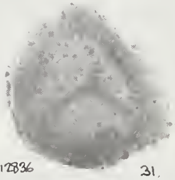
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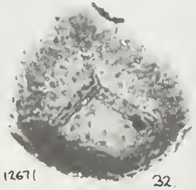
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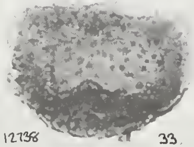
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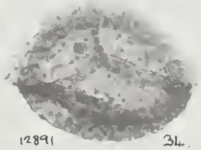
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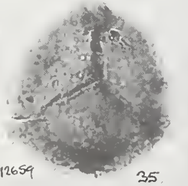
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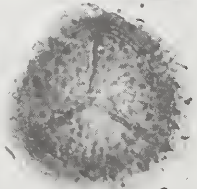
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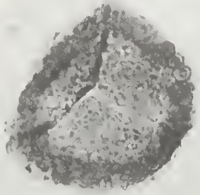
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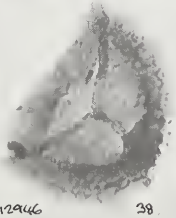
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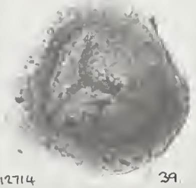
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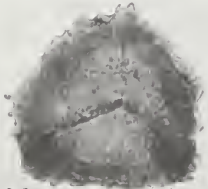
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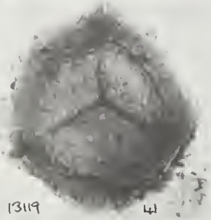
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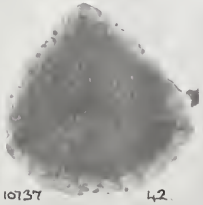
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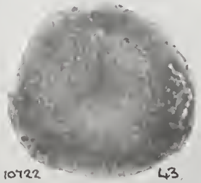
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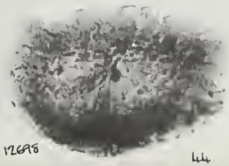
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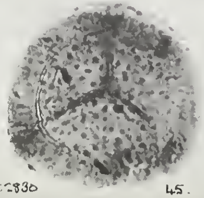
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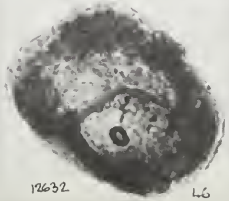
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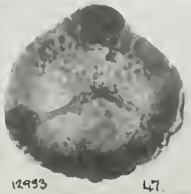
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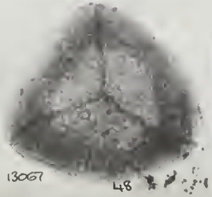
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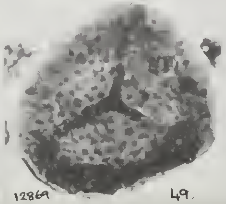
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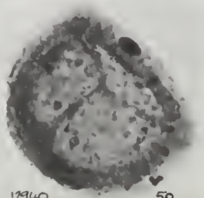
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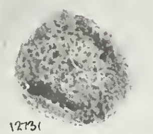
27

Gondisporites variabilis sp.nov. / G. splendens (Balme + Henn.'56) comb.nov.
pl 26-28 (in full) pl. 29-32 (in full)

: WV3 133,50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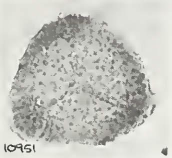
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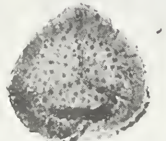
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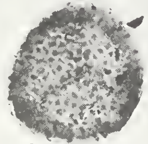
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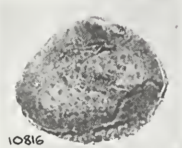
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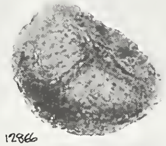
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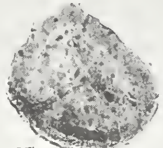
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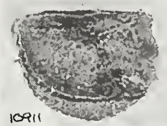
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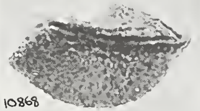
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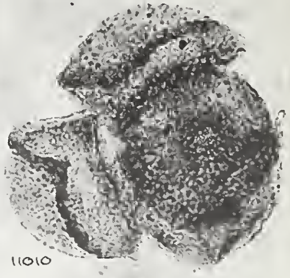
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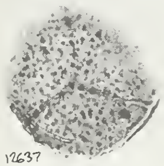
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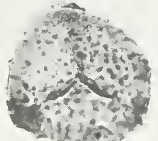
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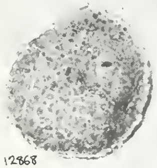
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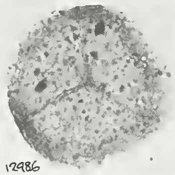
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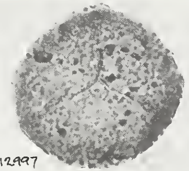
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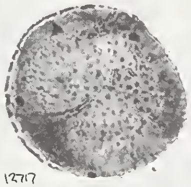
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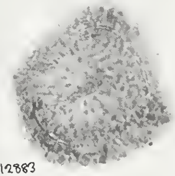
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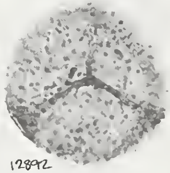
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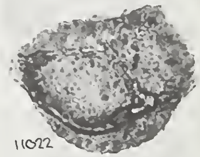
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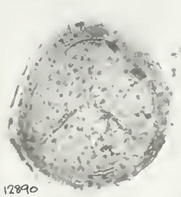
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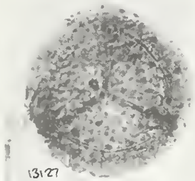
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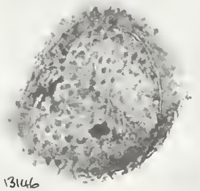
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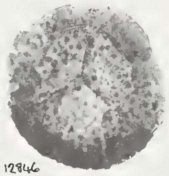
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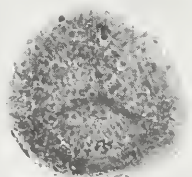
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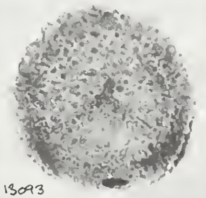
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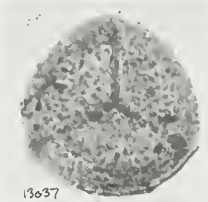
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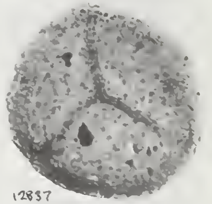
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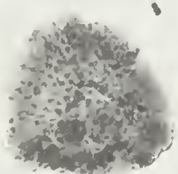
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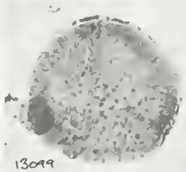
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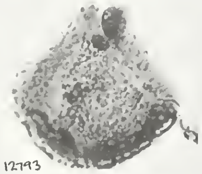
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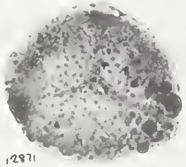
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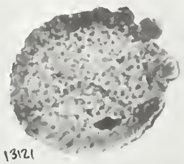
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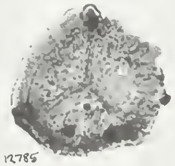
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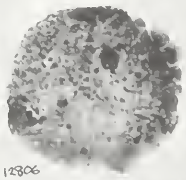
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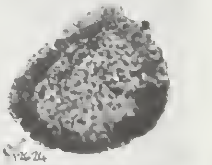
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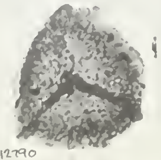
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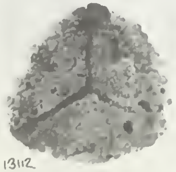
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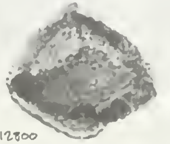
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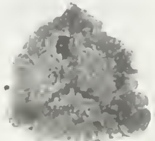
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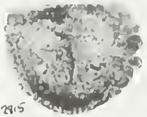
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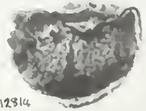
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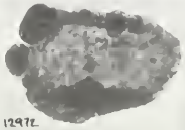
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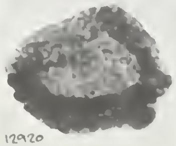
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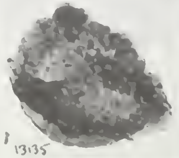
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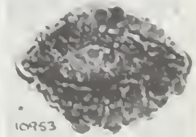
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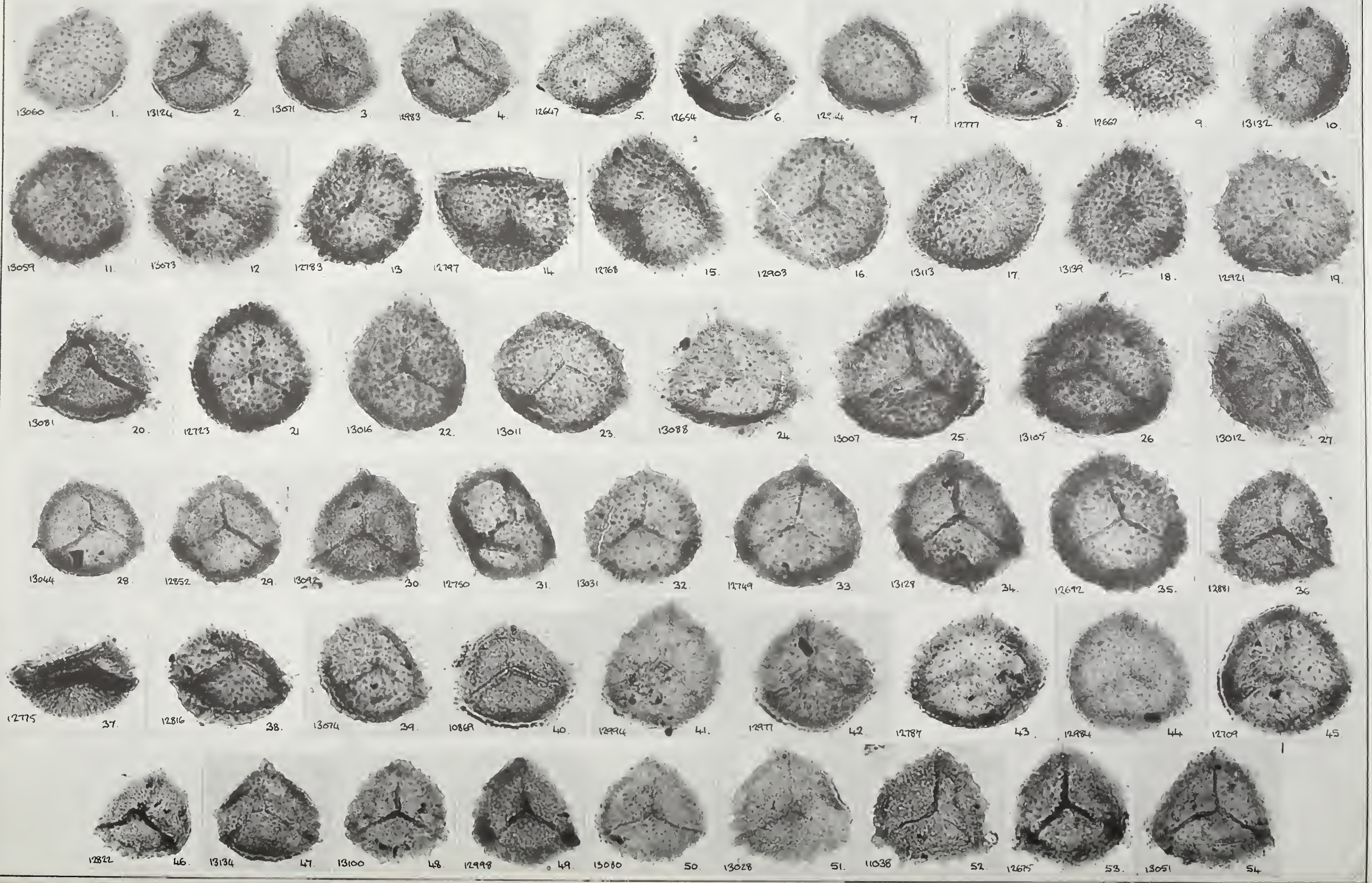
Gondisporites variabilis sp. nov./ G. splendens (Balme & Henn.'56) comb. nov.

pl. 26-28 (in full)
pl. 29-32 (in full)

: WV_3 133,50



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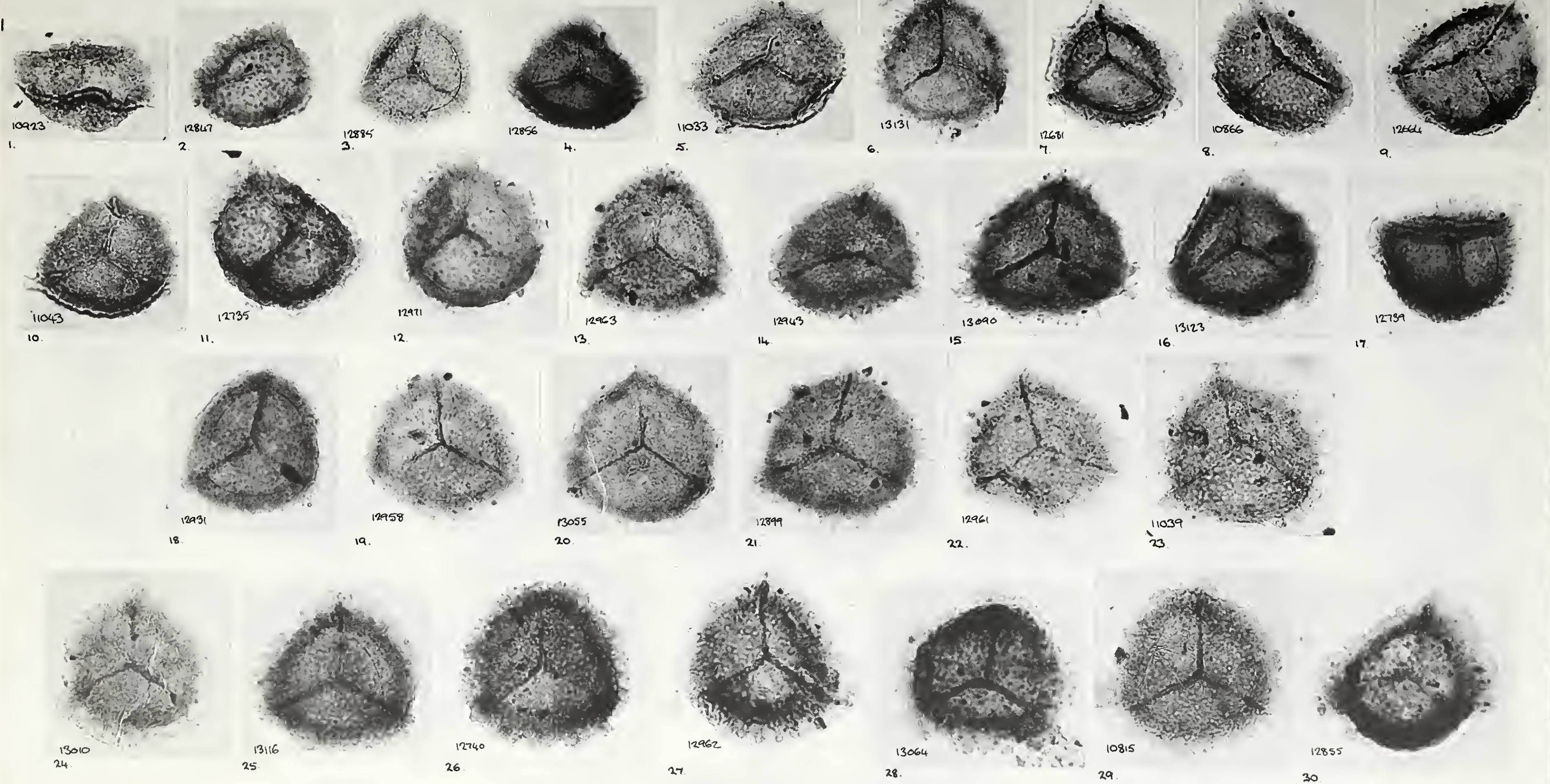
pl. 26-28 (in full) pl. 29-32 (in full)

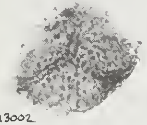
: WV3 133,50



Gondisporites variabilis sp. nov. / G. splendens (Balme & Henn. '56) comb. nov.

pl. 26-28 (in full) pl. 29-32 (in full)

: WV$_3$ 133,50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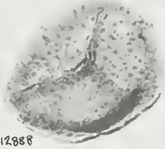
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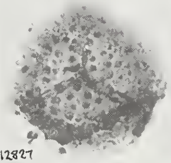
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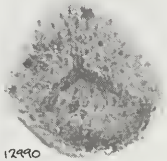
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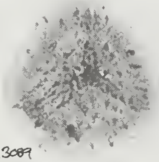
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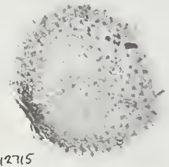
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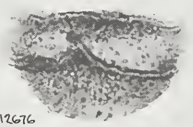
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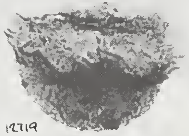
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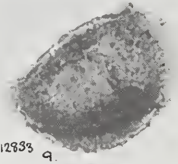
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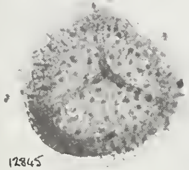
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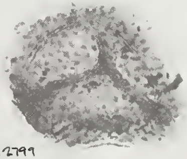
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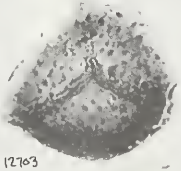
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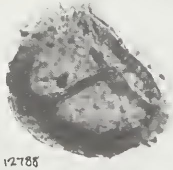
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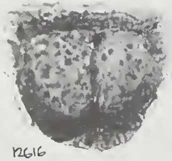
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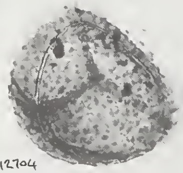
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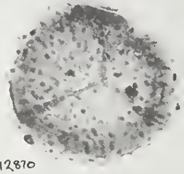
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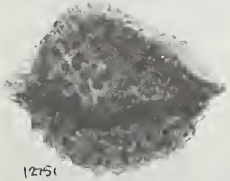
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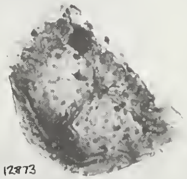
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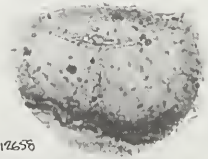
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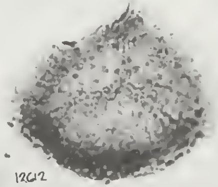
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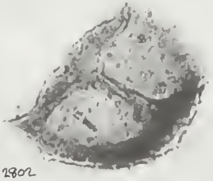
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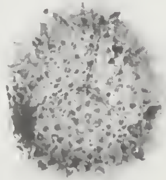
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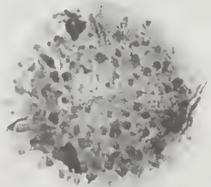
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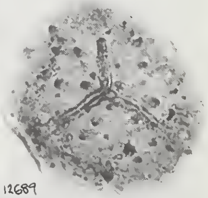
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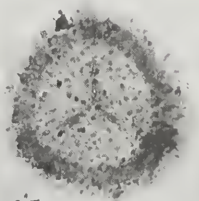
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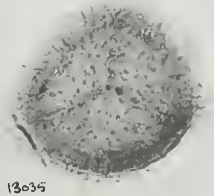
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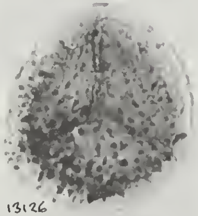
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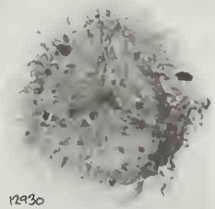
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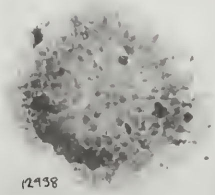
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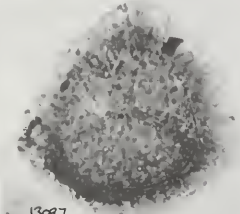
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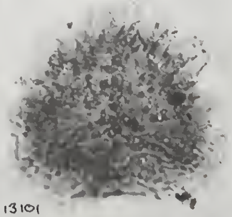
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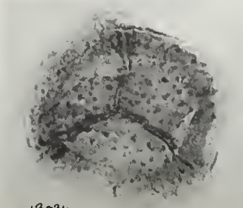
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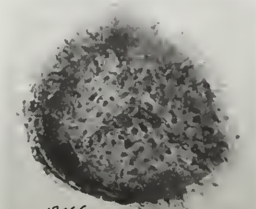
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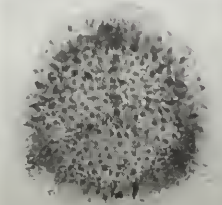
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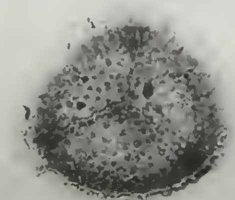
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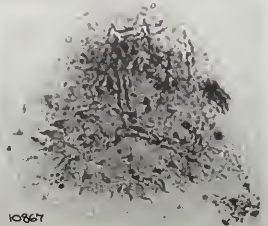
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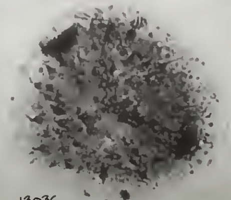
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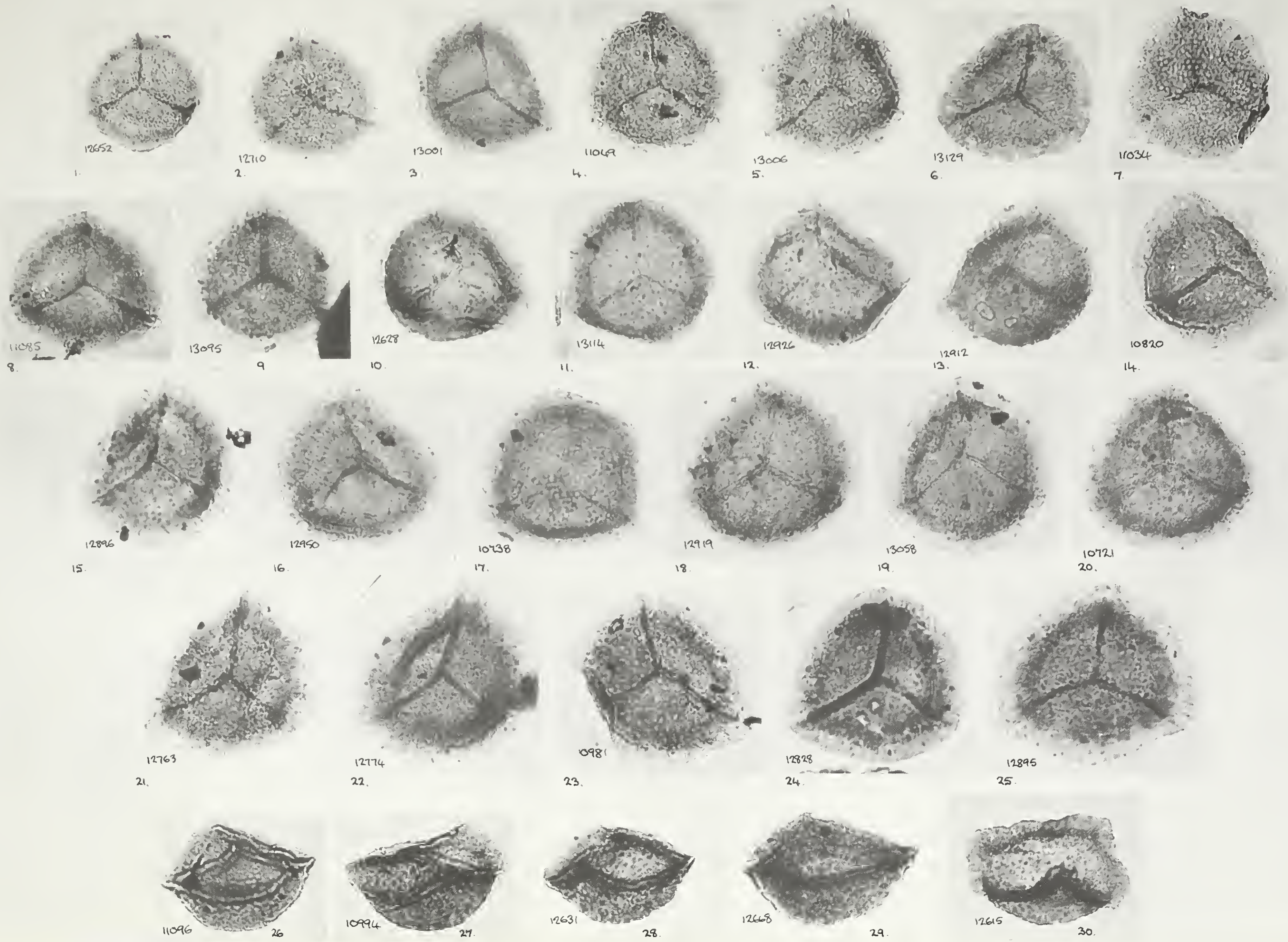
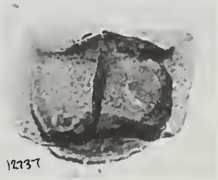
Gondisporites variabilis sp. nov./G. splendens (Balme & Henn.'56) comb. nov.
pl. 26-28 (in full) pl 29-32 (in full)

: WV3 133,50



Gondisporites variabilis sp. nov. / G. splendens (Balme + Henn. '56) comb. nov.
pl. 26-28 (in full)   pl. 29-32 (in full)

: WV3 133,50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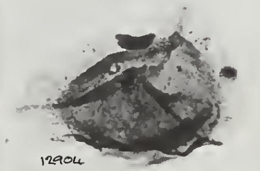
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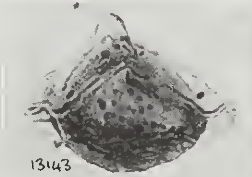
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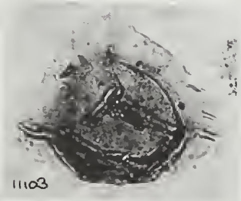
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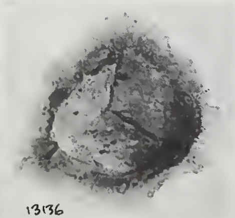
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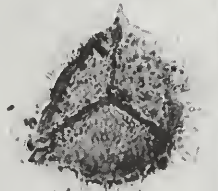
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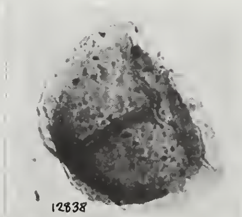
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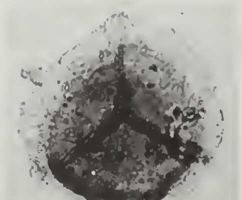
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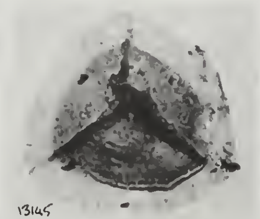
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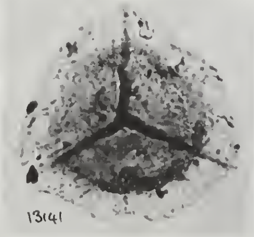
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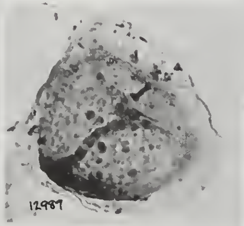
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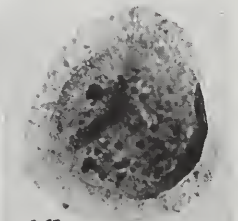
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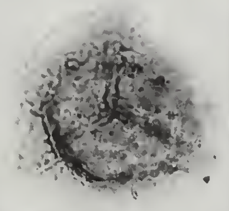
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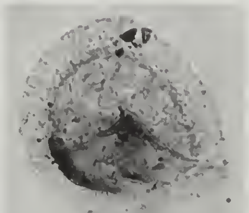
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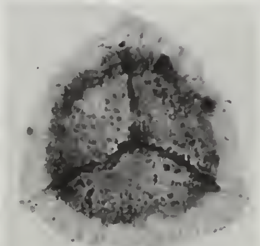
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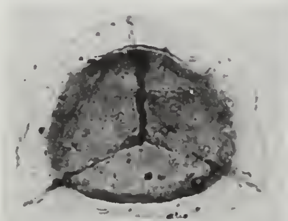
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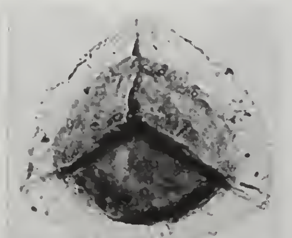
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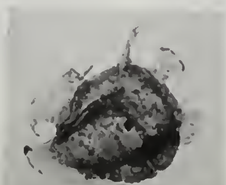
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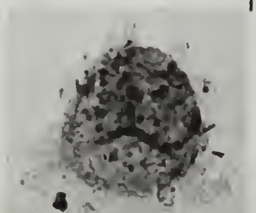
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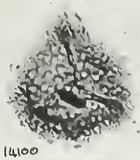
Gondisporites splendens (Balme & Henn. '56) comb. nov.

o SAP 6 1130'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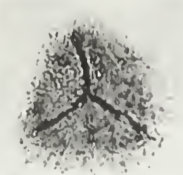
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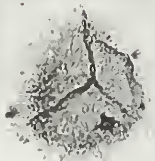
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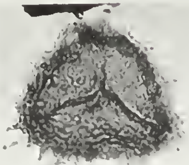
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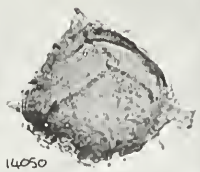
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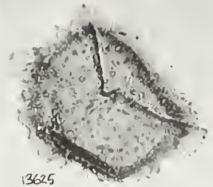
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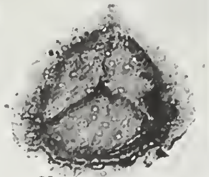
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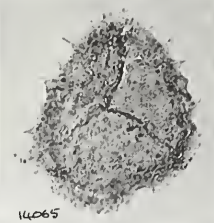
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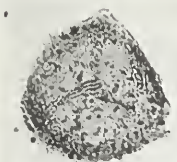
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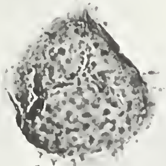
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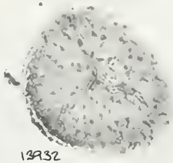
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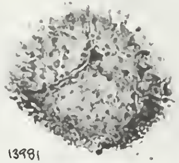
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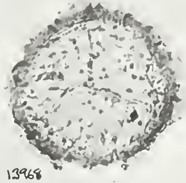
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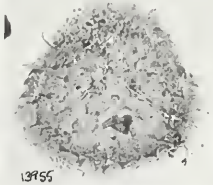
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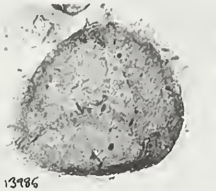
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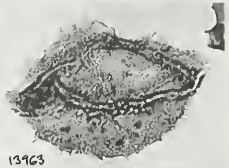
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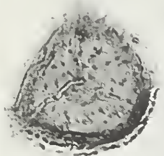
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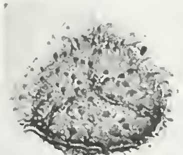
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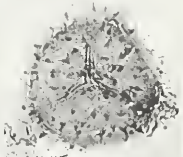
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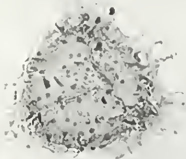
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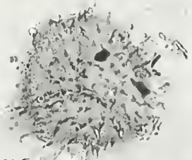
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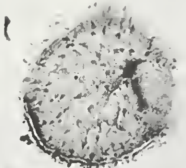
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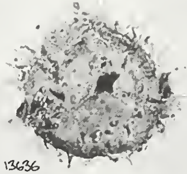
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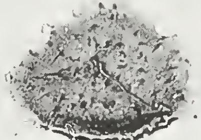
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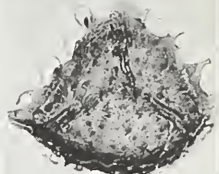
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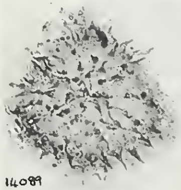
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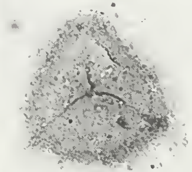
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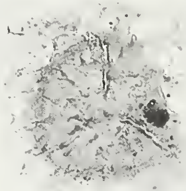
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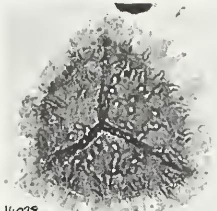
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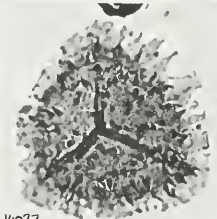
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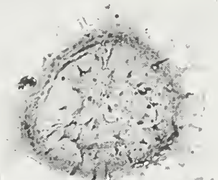
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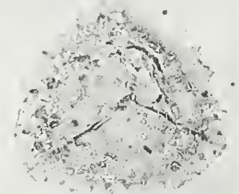
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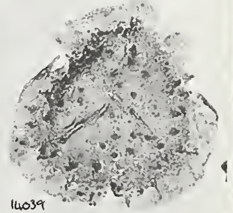
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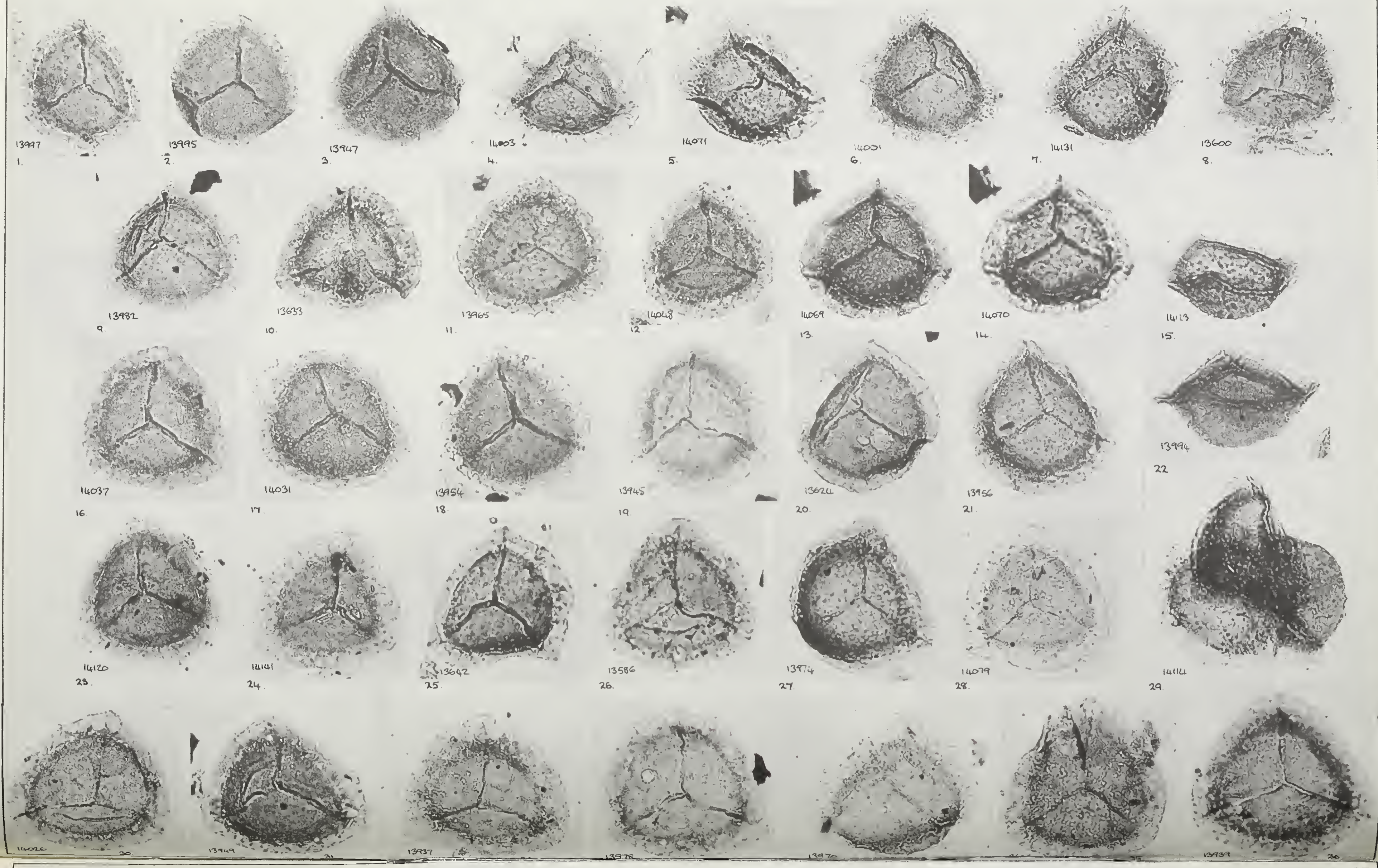
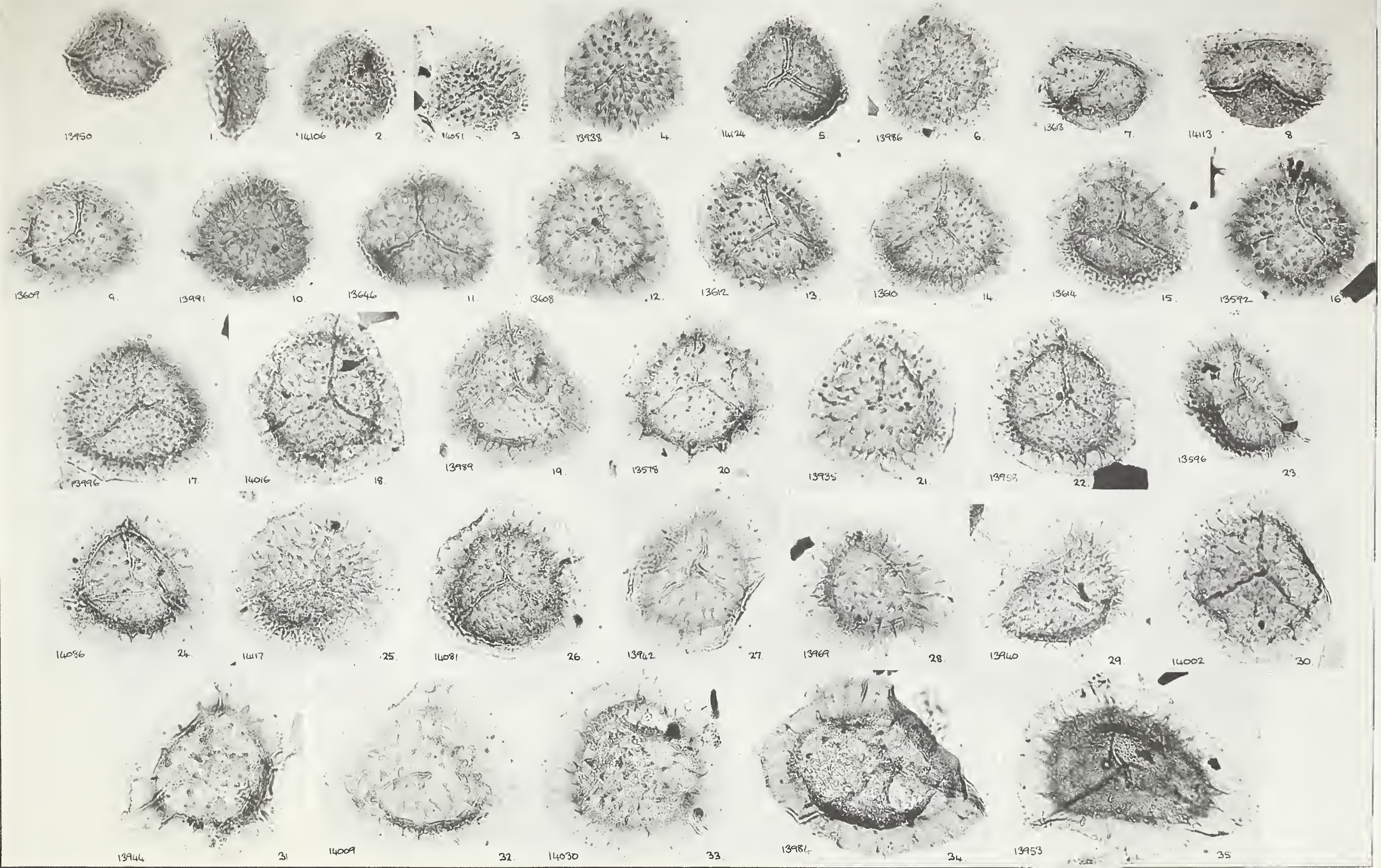
Gondisporites splendens (Balme & Henn. '56) comb. nov.

o SAP 6 1130'



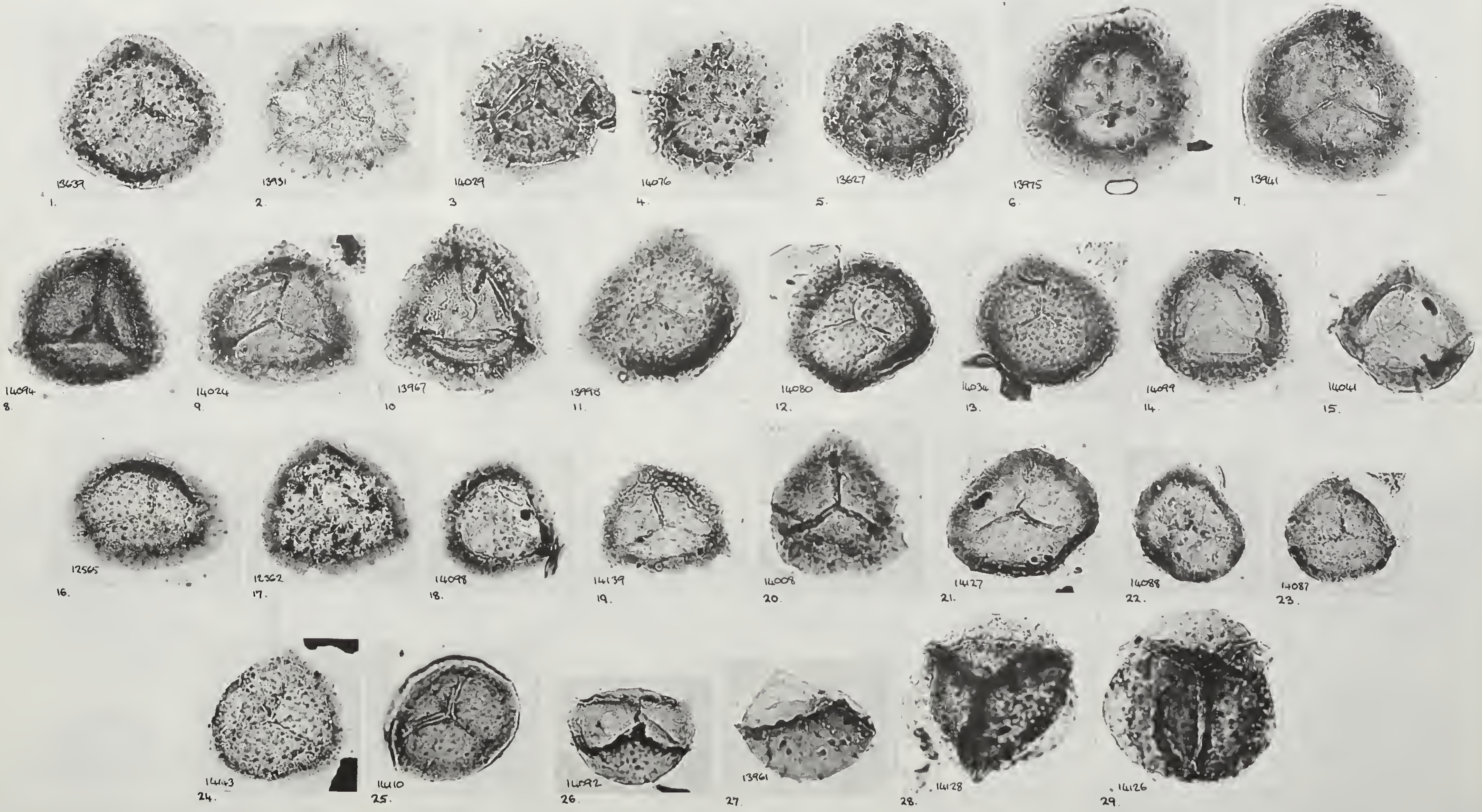
Gondisporites splendens (Balme + Henn.'56) comb. nov.

o SAP 6 1130'



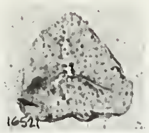
Gondisporites splendens (Balme & Henn.'56) comb. nov.

0 SAP 6 1130'



Acanthotriletes (various forms)

8 UC 608 1262'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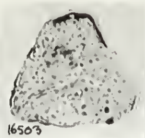
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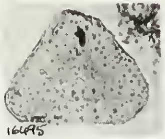
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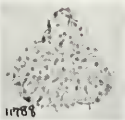
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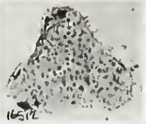
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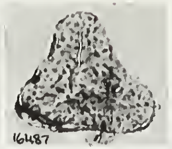
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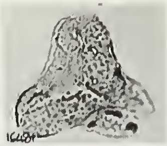
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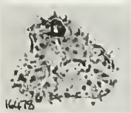
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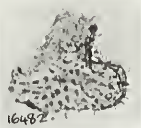
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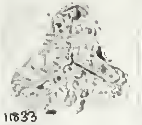
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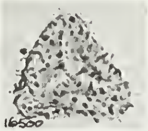
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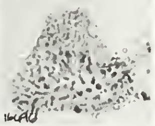
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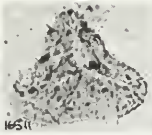
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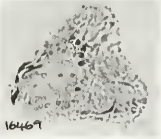
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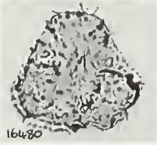
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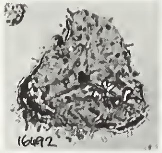
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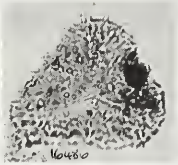
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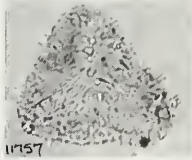
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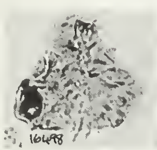
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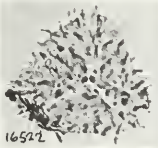
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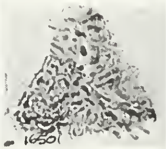
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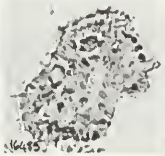
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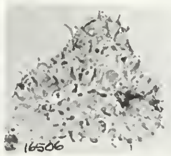
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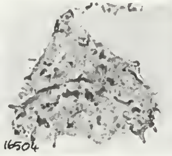
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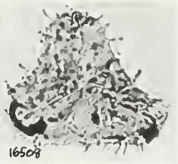
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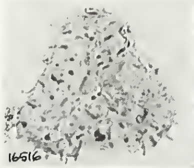
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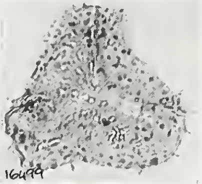
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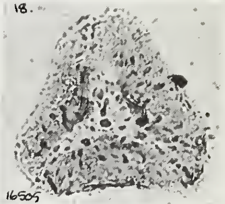
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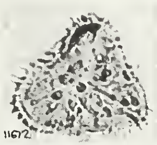
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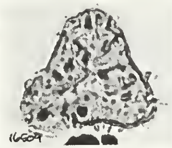
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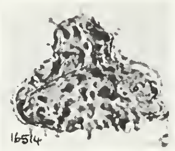
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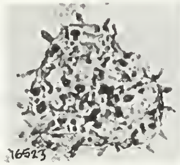
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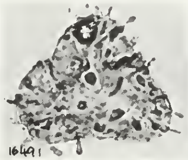
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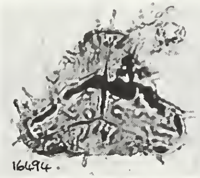
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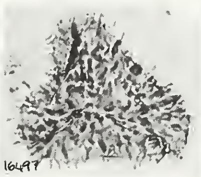
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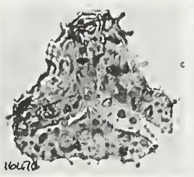
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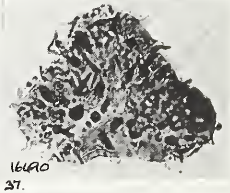
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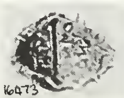
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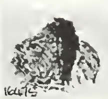
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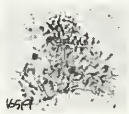
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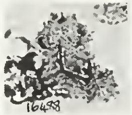
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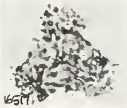
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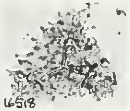
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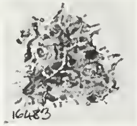
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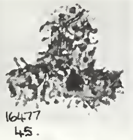
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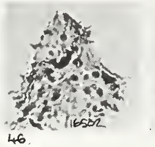
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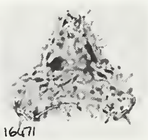
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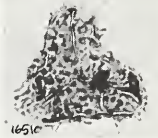
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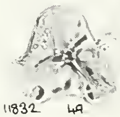
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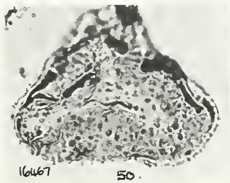
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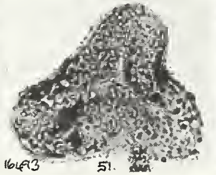
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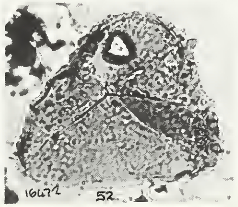
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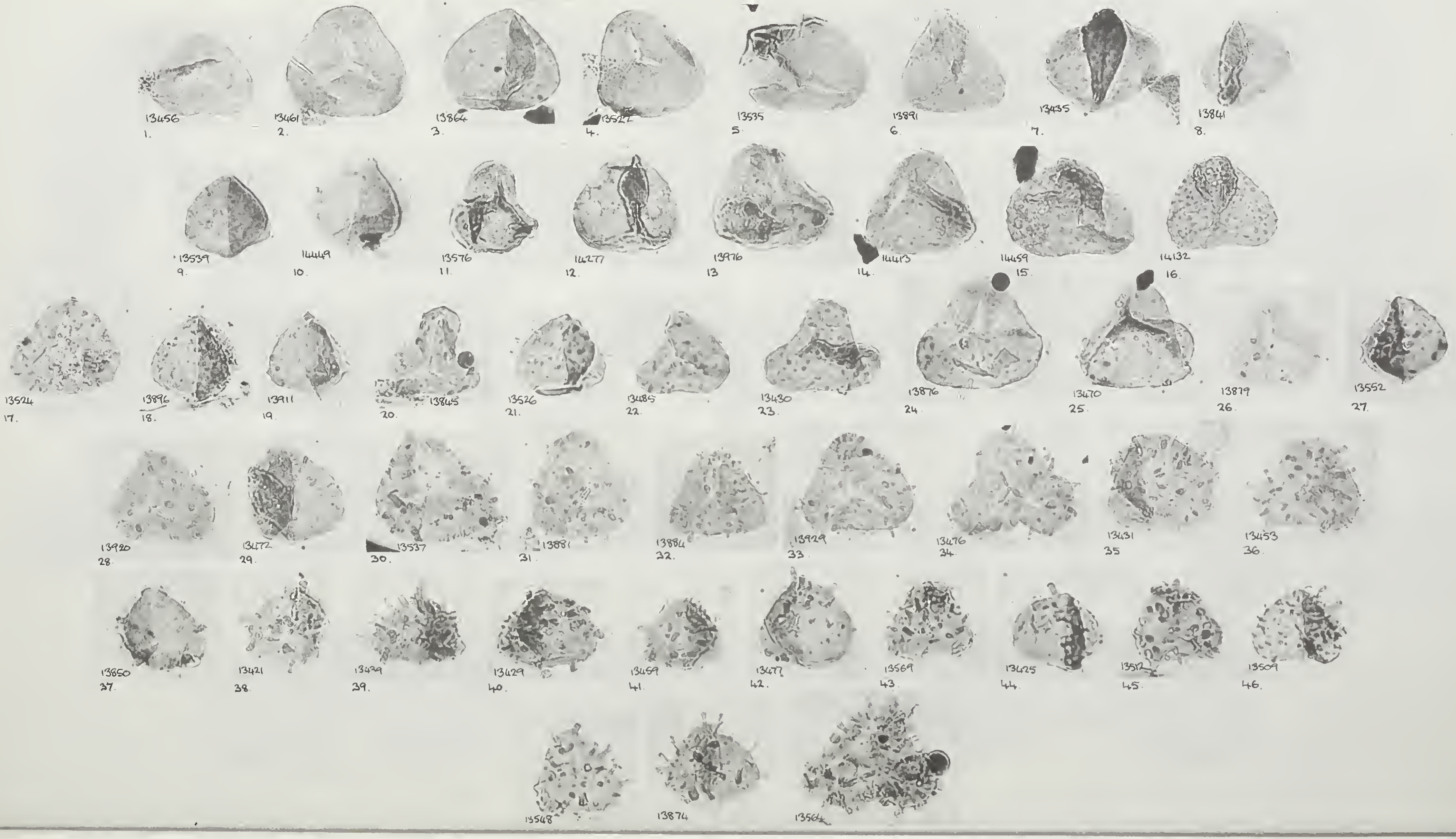
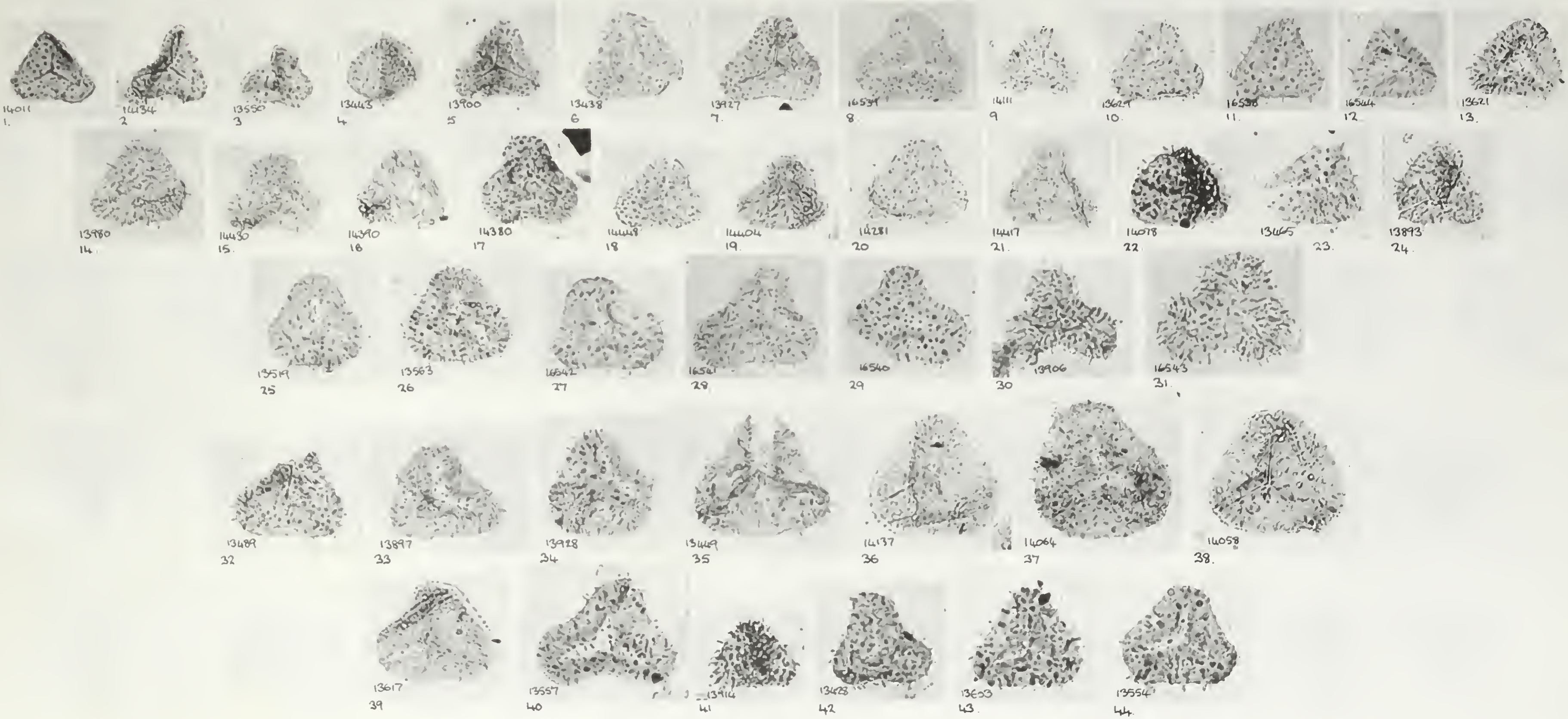
Acanthotriletes (various forms)

ooooo SAP 6 1130', 1131', 1133'



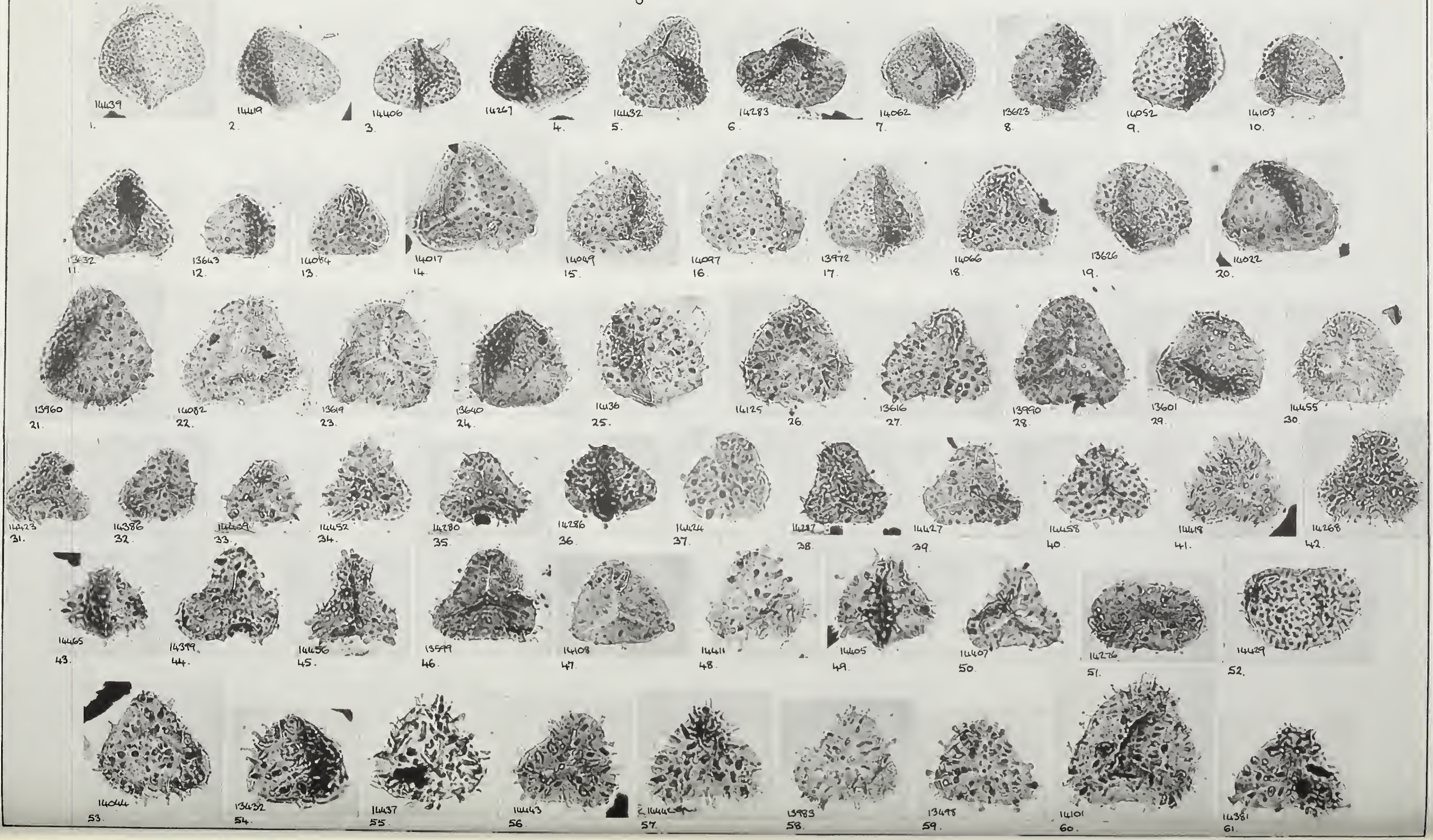
Acanthotriletes (various forms)

SAP 6 1130', 1131', 1133'



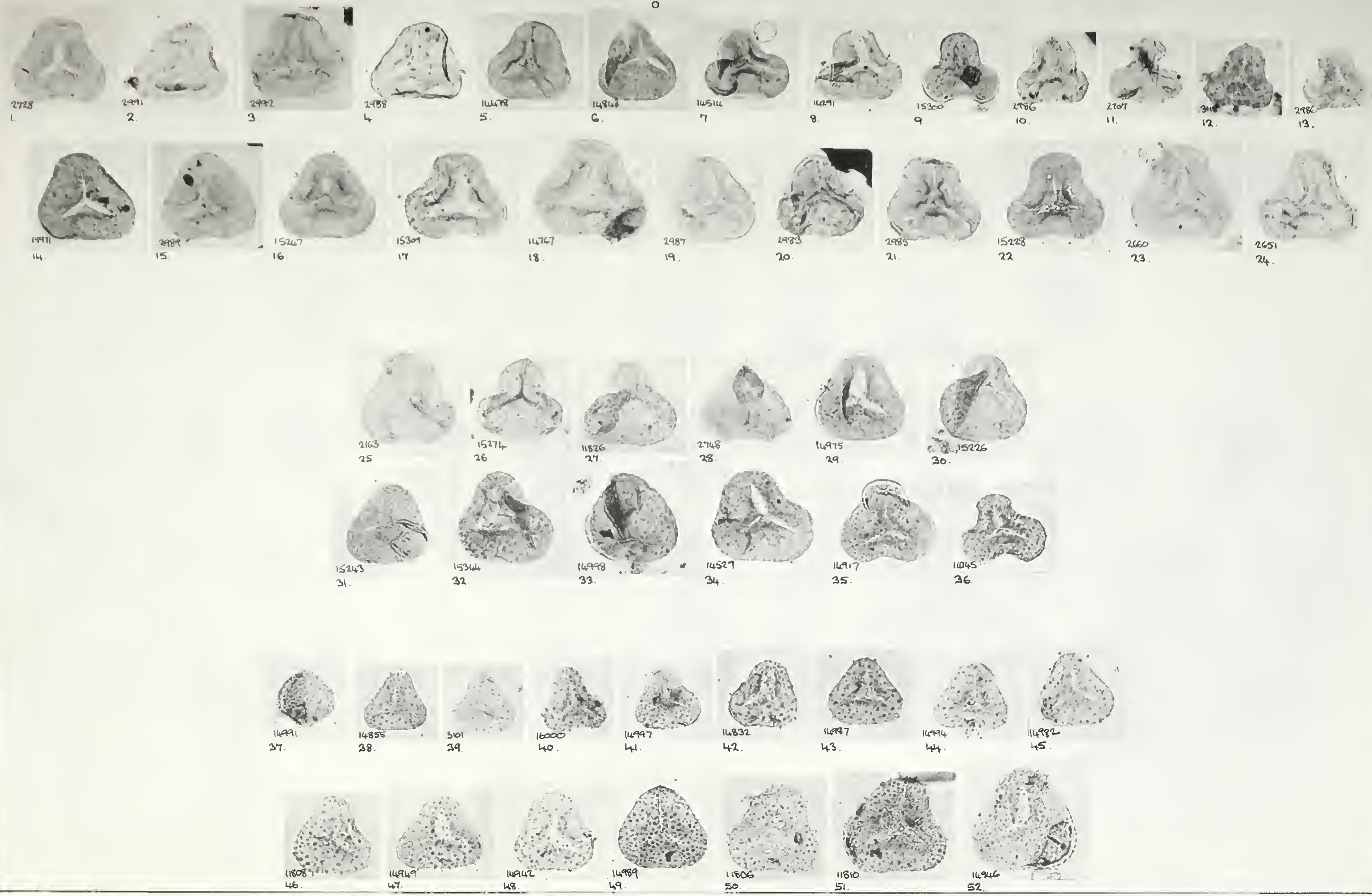
Acanthotriletes (various forms)

SAP 6 1130', 1131', 1133'

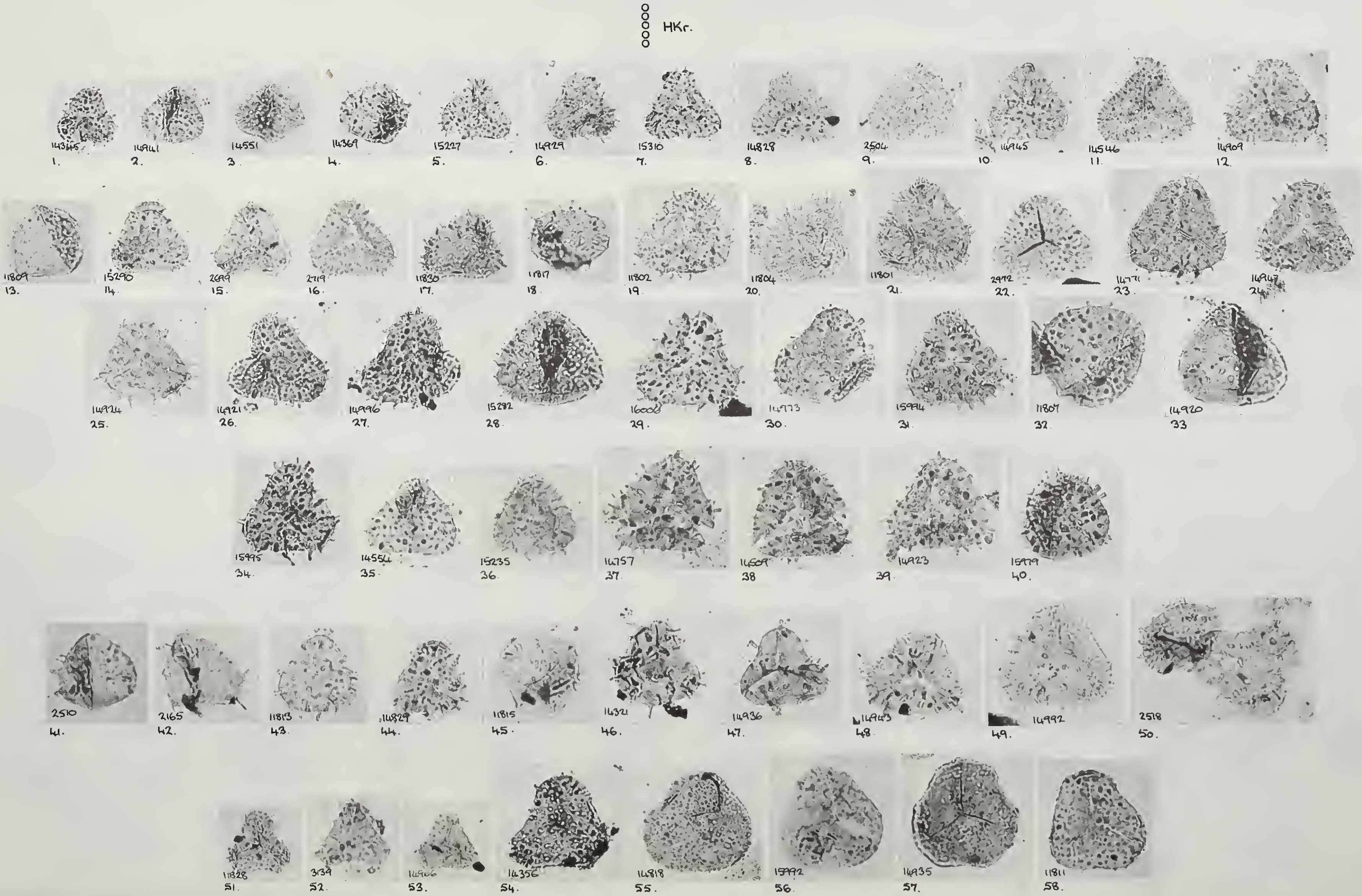


Acanthotriletes (levigate + granulate forms)

HKr.

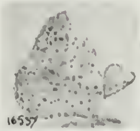


Acanthotriletes (various forms)



Acanthotriletes (granulate form)

0 Kb.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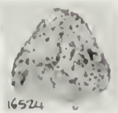
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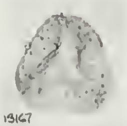
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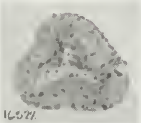
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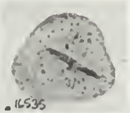
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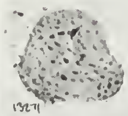
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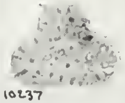
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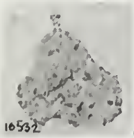
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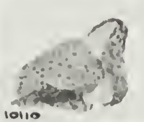
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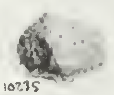
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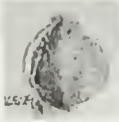
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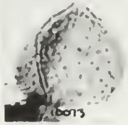
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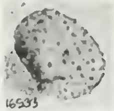
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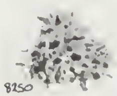
Acanthotriletes (spinate form)

0 Kb.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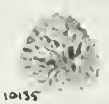
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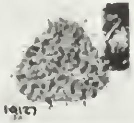
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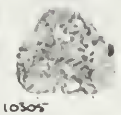
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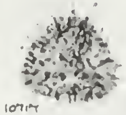
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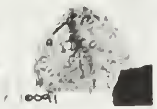
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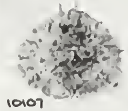
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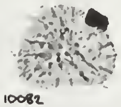
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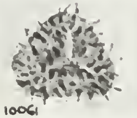
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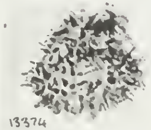
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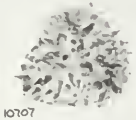
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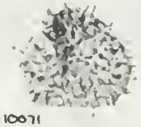
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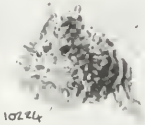
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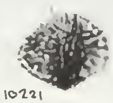
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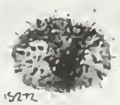
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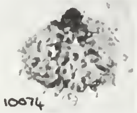
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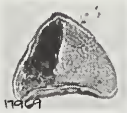
Microbaculispora labyrinthica sp. nov.

● SAP 7 338'



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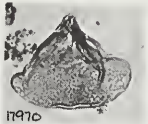

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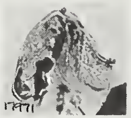

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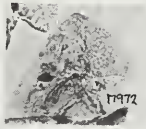

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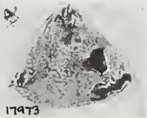

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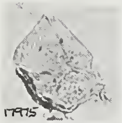
○ SAP 6 521'



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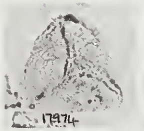

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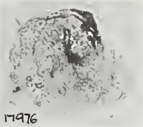

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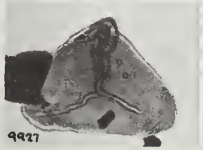
Microbaculispora microreticulata sp. nov. / M. directa (Balme + Henn. '56) comb. nov. / M. plicata (Mahesh. + Bose '69) comb. nov. / M. virkkiae (Tiw. '65) comb. nov.
pl. 44 (9-31) pl. 45 (1-18) pl. 45 (19-26) pl. 45 (27-38)

●
○
○ SAP 6 1130'
○



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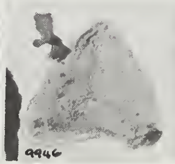

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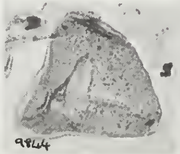

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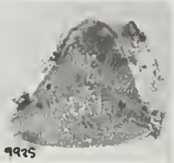

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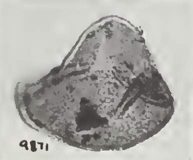

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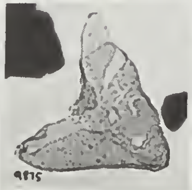

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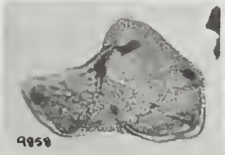

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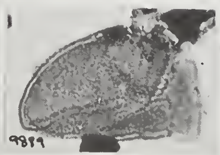

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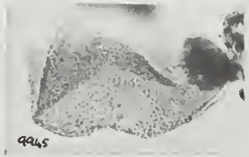

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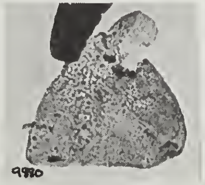

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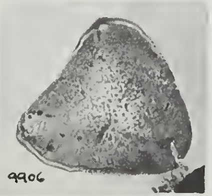

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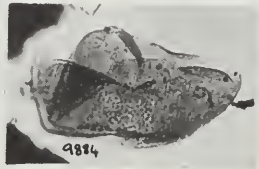

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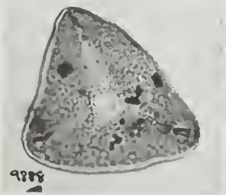

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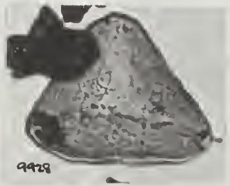

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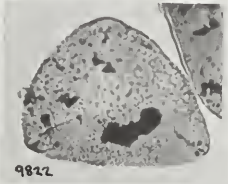

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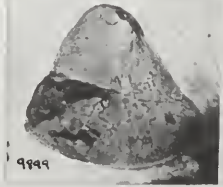

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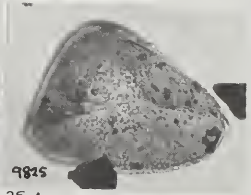

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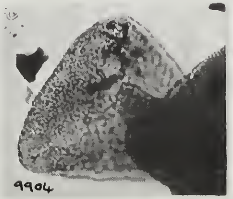

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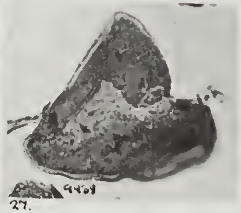

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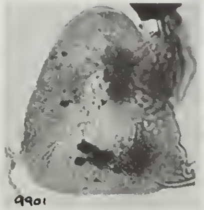

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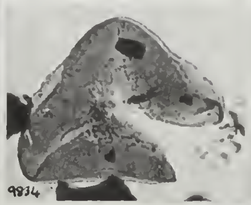

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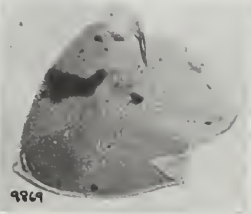

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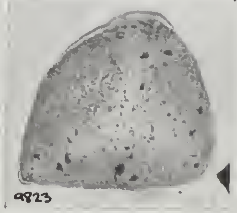

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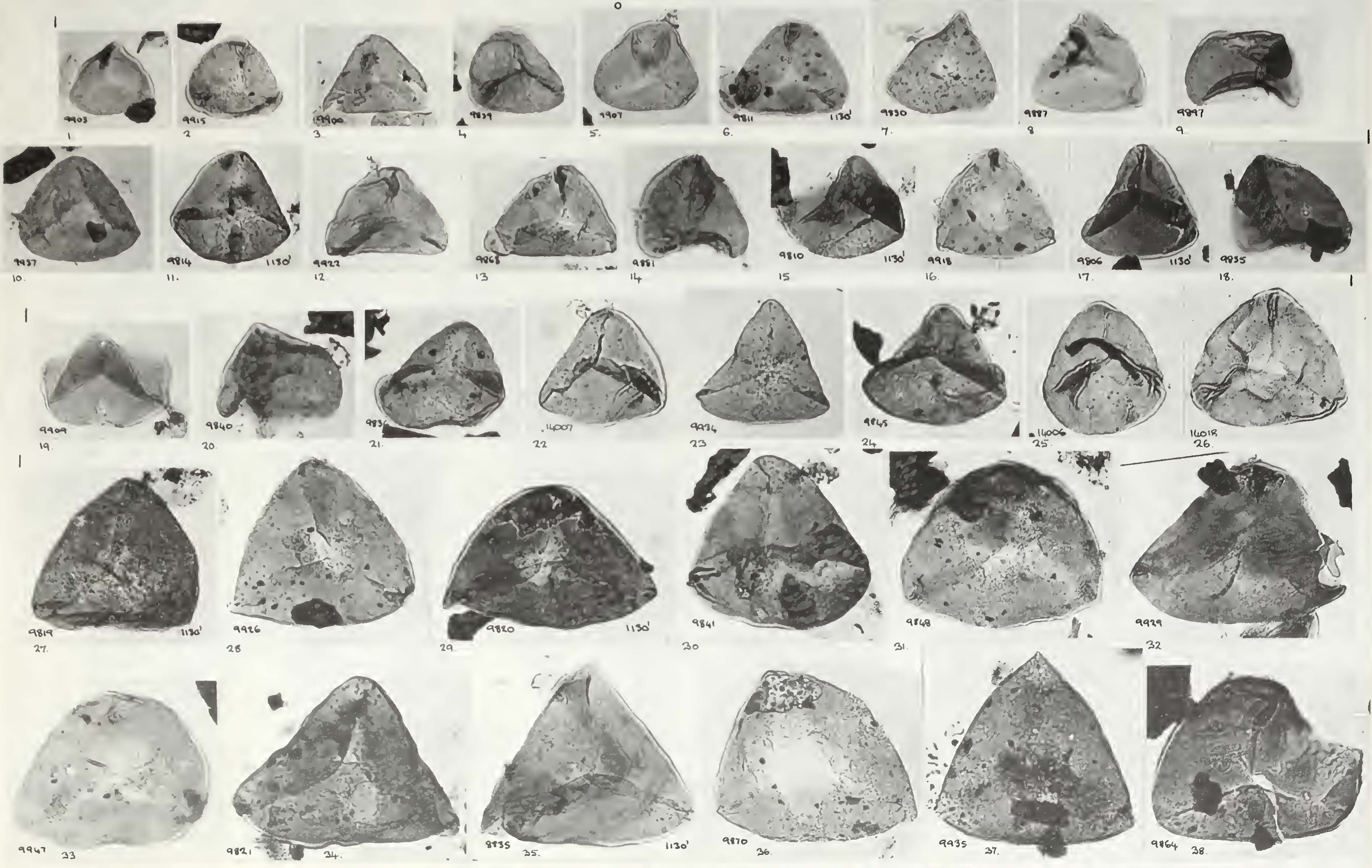
Microbaculispora microreticulata sp.nov. / M. directa (Balme & Henn.'56) comb. nov. / M. plicata (Mahesh. & Bose '69) comb. nov. / M. virkkiae (Tiw.'65) comb. nov.

pl 44 (9-31) / pl 45 (1-18) / pl. 45 (19-26) / pl. 45 (27-38)

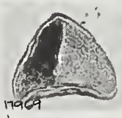
SAP 6 1130'



Microbaculispora labyrinthica sp. nov.

● SAP 7 338'

○ SAP 6 521'



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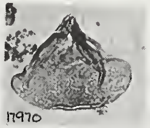

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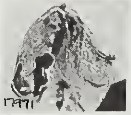

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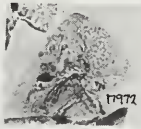

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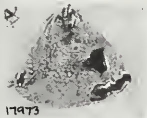

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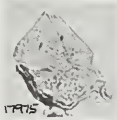

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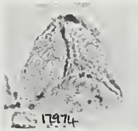

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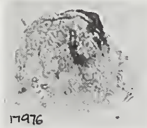

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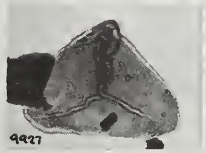
Microbaculispora microreticulata sp. nov. / M. directa (Balme + Henn.'56) comb. nov. / M. plicata (Mahesh. + Bose '69) comb. nov. / M. virkkiae (Tiw. '65) comb. nov.

pl. 44 (9-31) pl. 45 (1-18) pl. 45 (19-26) pl. 45 (27-38)

●○○○ SAP 6 1130'



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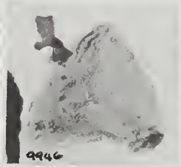

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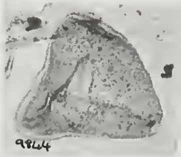

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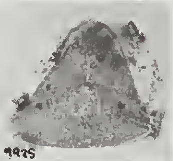

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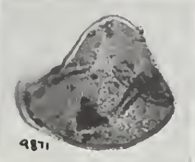

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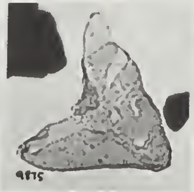

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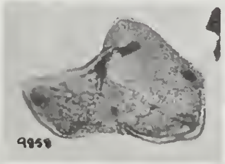

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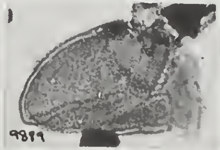

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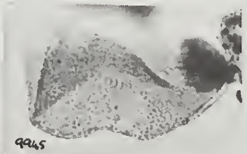

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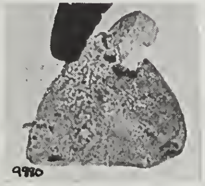

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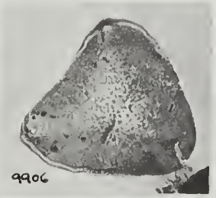

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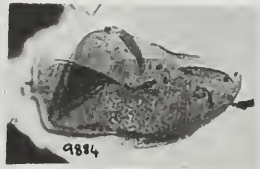

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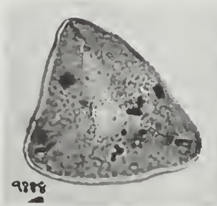

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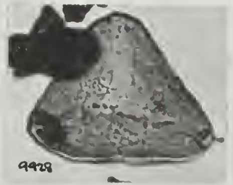

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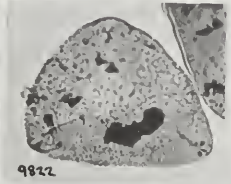

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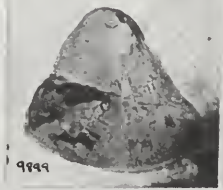

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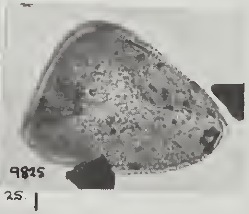

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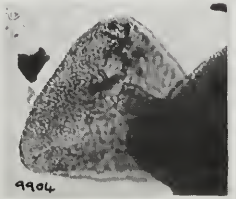

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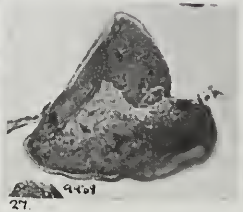

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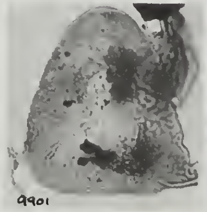

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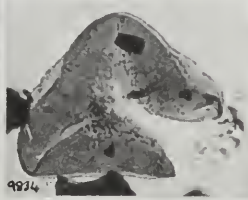

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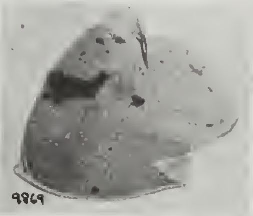

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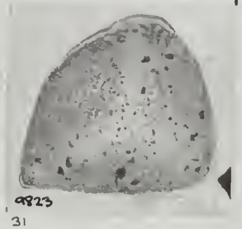
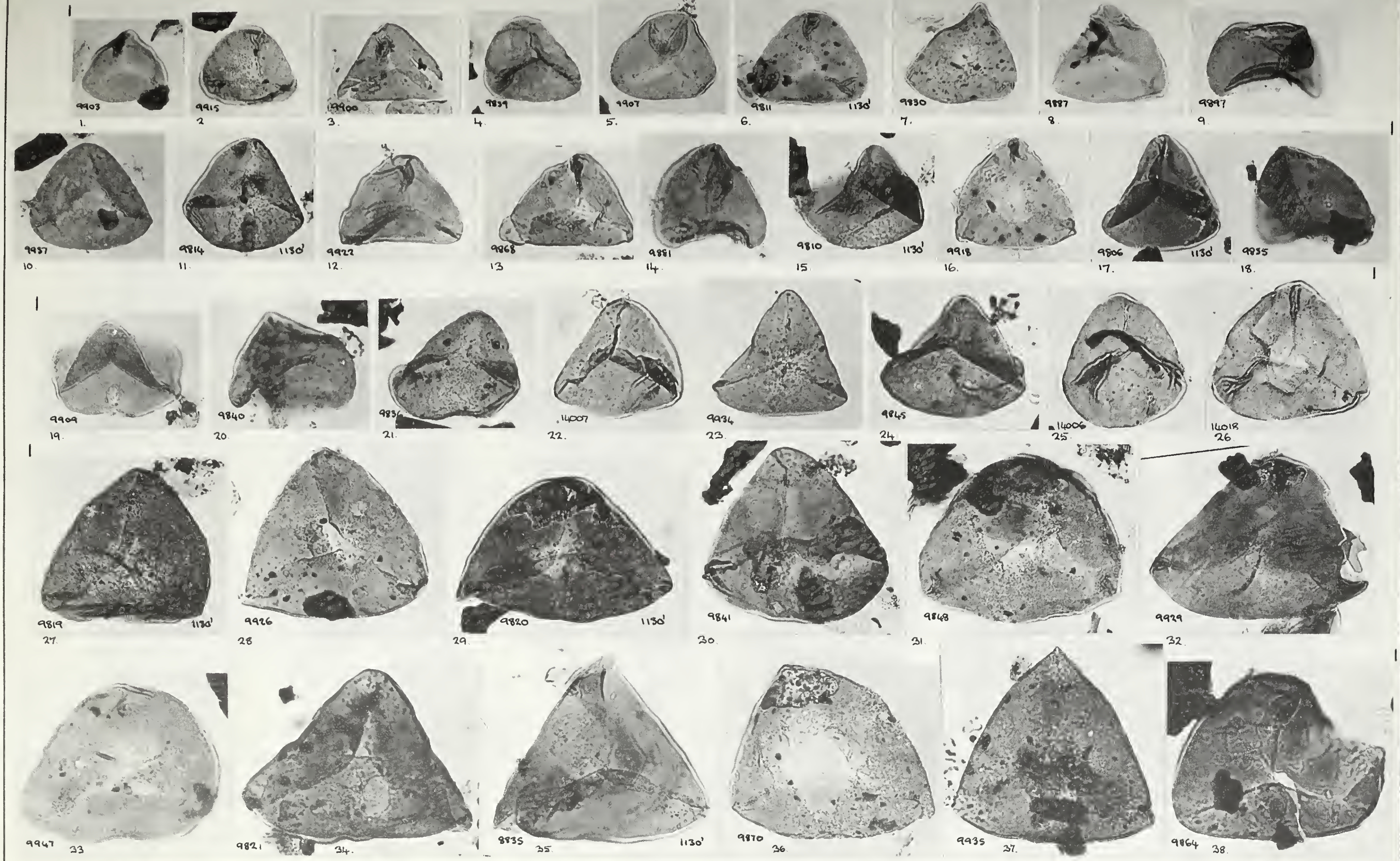


31

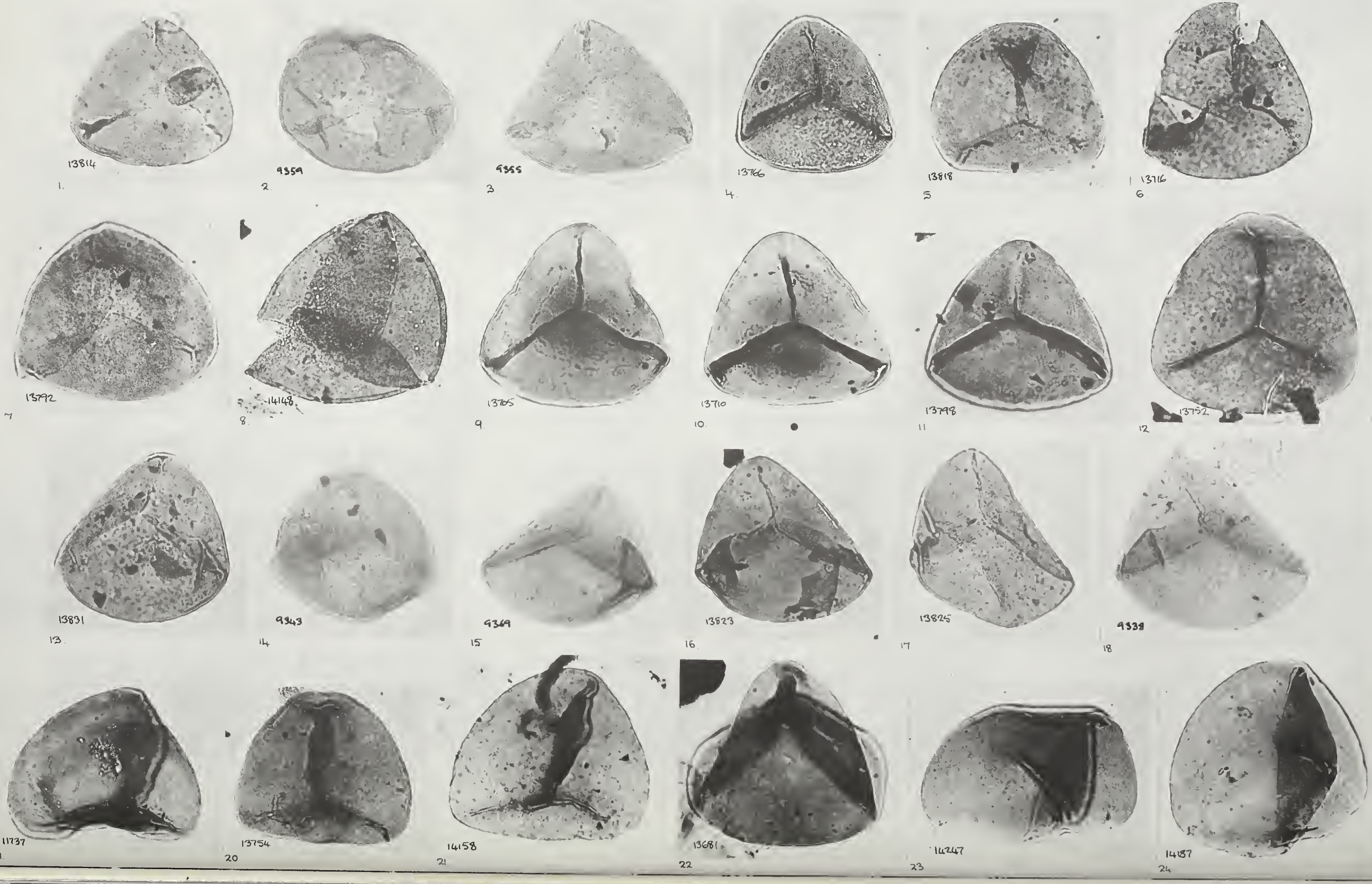
Microbaculispora microreticulata sp.nov. / M. directa (Balme & Henn.'56) comb. nov. / M. plicata (Mahesh. & Bose '69) comb. nov. / M. virkkiae (Tiw. '65) comb. nov.
pl. 44 (9-31) pl. 45 (1-18) pl. 45 (19-26) pl. 45 (27-38)

SAP 6 1130'



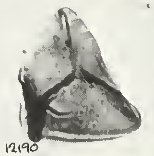
Microbaculispora virkkiae (Tiw. '65) comb.nov.

● SAP 6 1151'3", 1152'3", 1152'9"

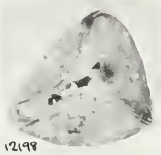


Microbaculispora directa (Balme + Henn.'56) comb. nov. / M. plicata (Mahesh. + Bose '69) comb. nov. / M. virkkiae (Tiw.'65) comb. nov.
pl. 47 (1-7) pl. 47 (8-12) pl. 47 (13,14)

● ● ○ UC 678 30,6 ; 31,6



1 ●



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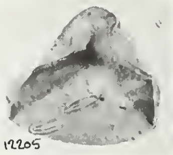

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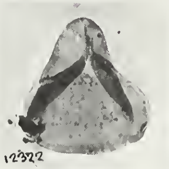

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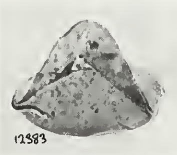

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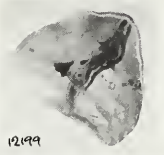
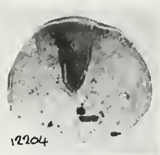


b|c 6.



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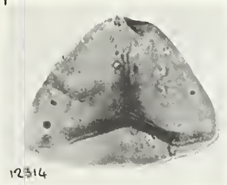

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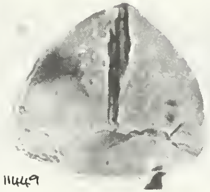

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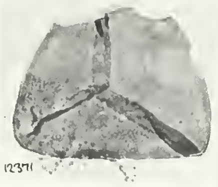

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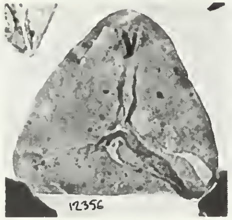

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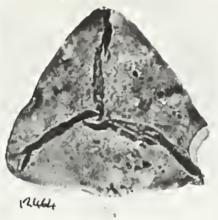
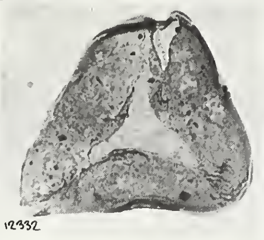


12 ●



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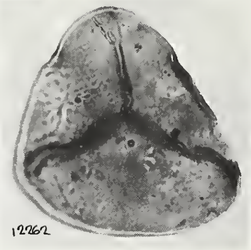
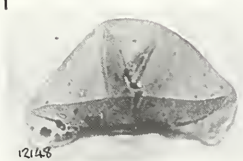


14.

Microbaculispora plicata (Mahesh. + Bose '69) comb. nov. / M. virkkiae (Tiw.'65) comb. nov.
pl. 47 (15-17) pl. 47 (18,19)

○ ○ UC 621 153'



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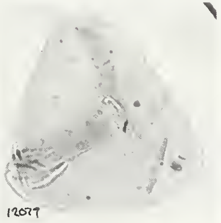

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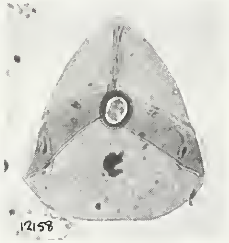

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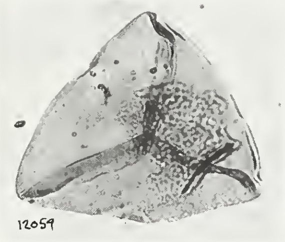

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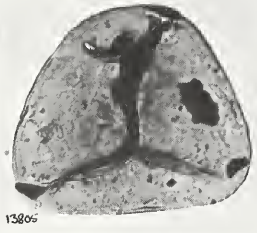
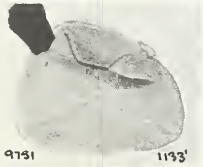


19.

Microbaculispora plicata (Mahesh. + Bose '69) comb. nov.
0 SAP 6 1133'



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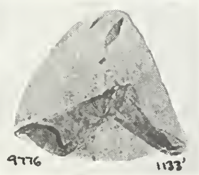

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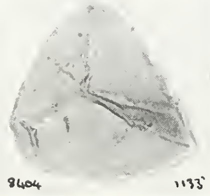

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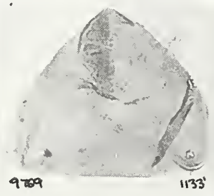

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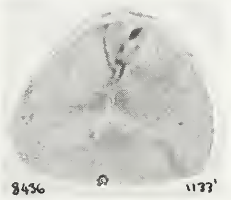

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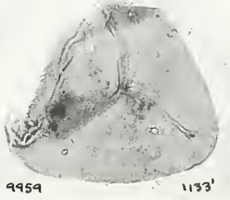

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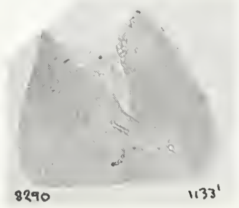

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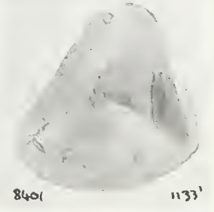
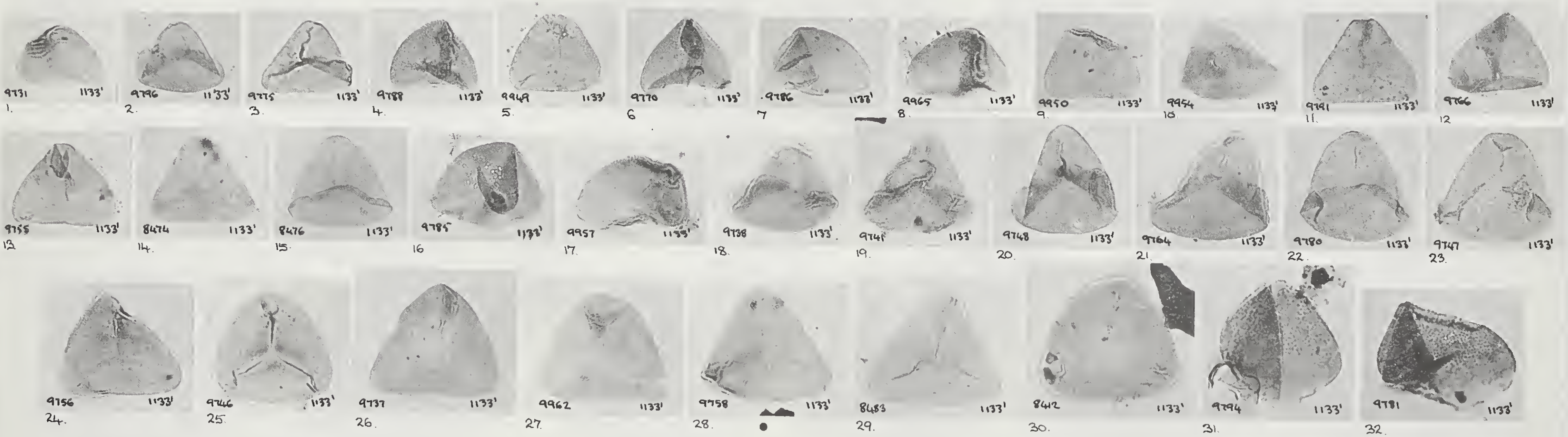


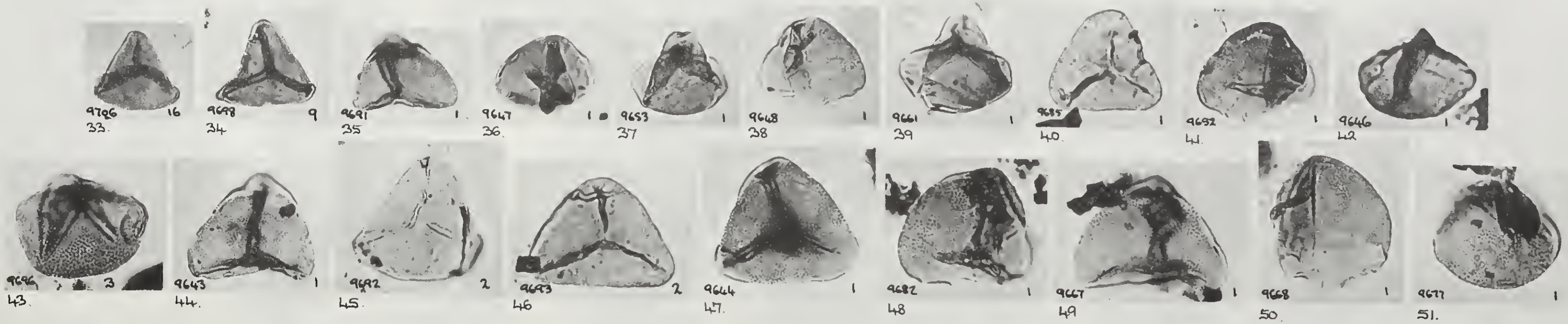
27

Microbaculispora tentula Tiw.'65

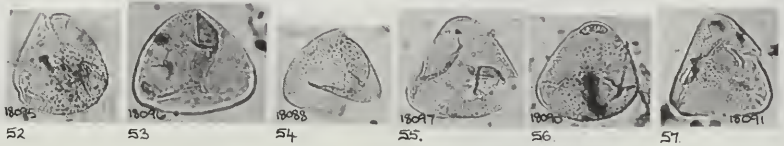
● SAP 6 1133'



○ HKr.

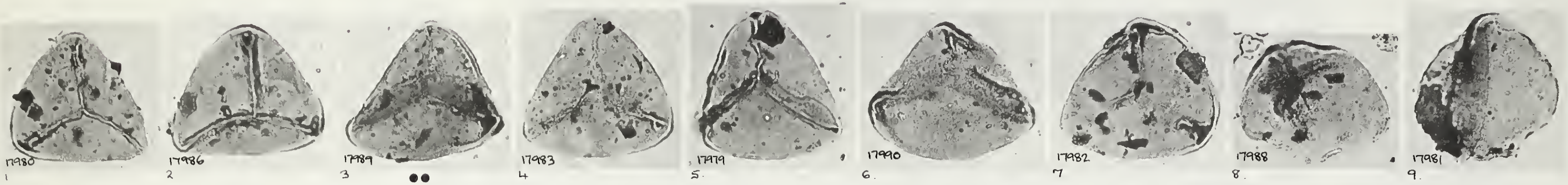


○ UC 729 555,0



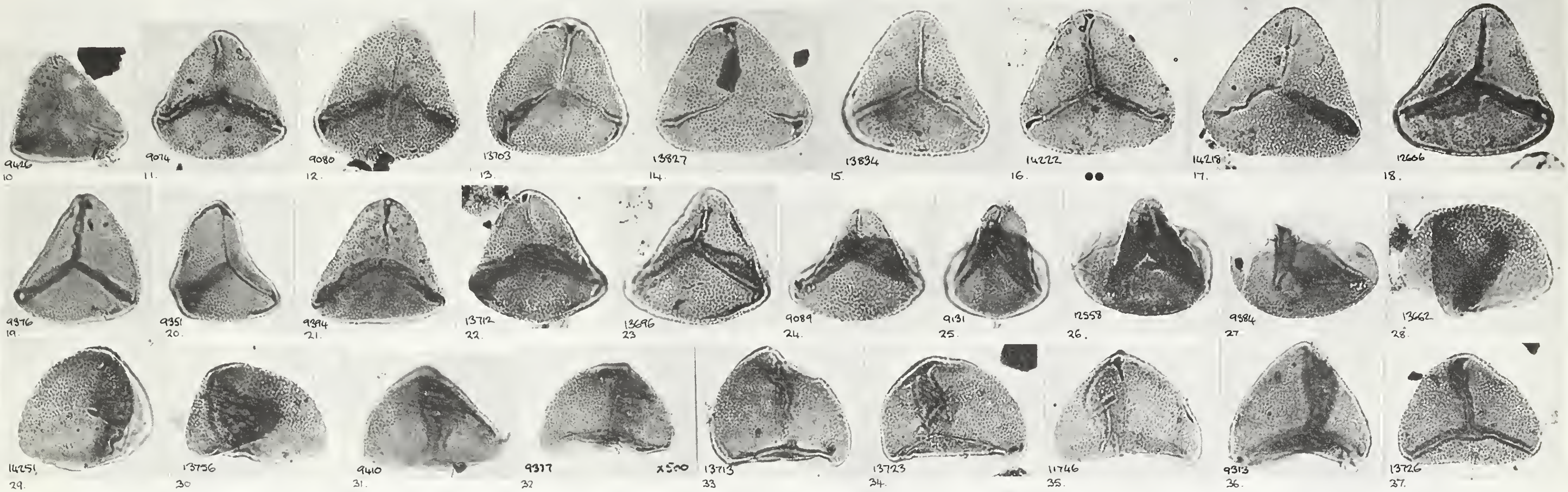
Microbaculispora finegranulata sp. nov.

● P 13 153,39



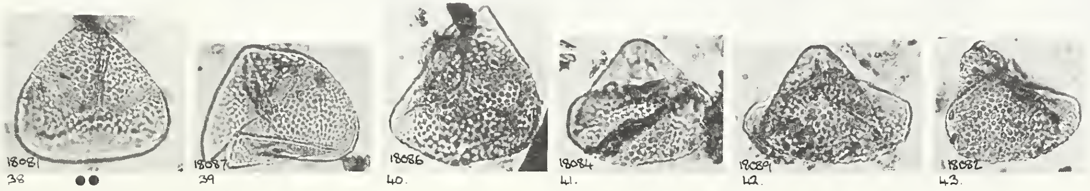
Microbaculispora mediogranulata sp. nov.

● SAP 6 1151'3", 1152'3", 1152'9"

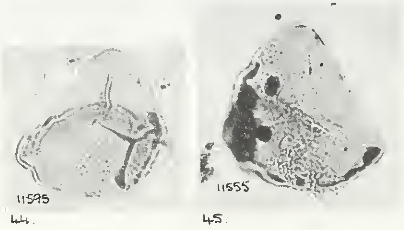


Microbaculispora grandegranulata sp. nov.

● UC 729 556,0

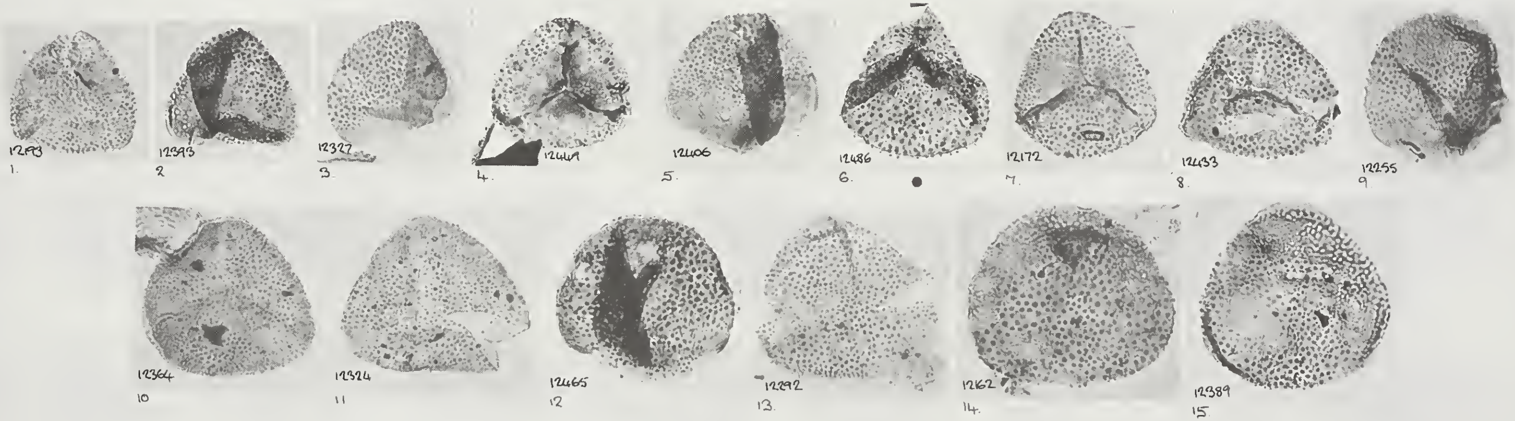


○ UC 608 1262'

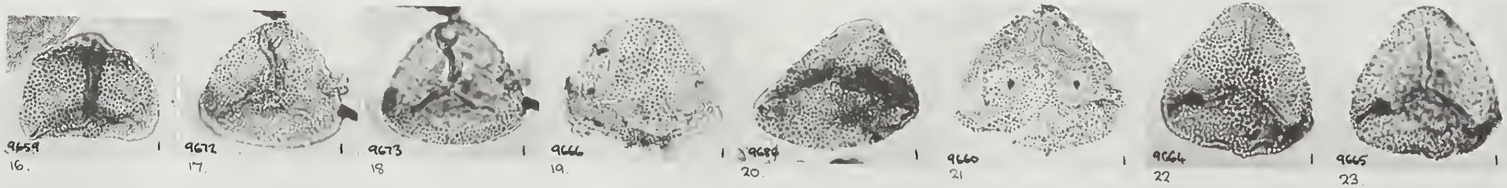


Microbaculispora micronodosa (Balme + Henn. '56) comb. nov.

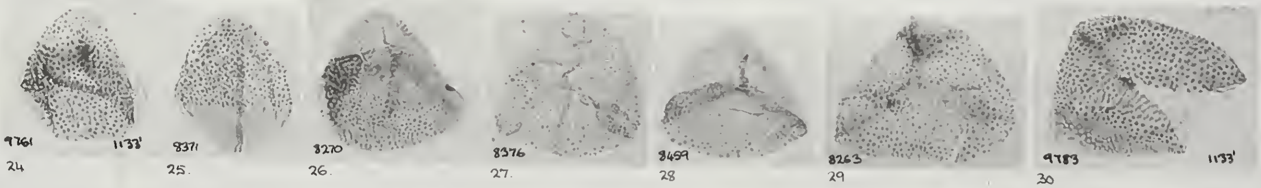
● UC 678 30,6, 31,6



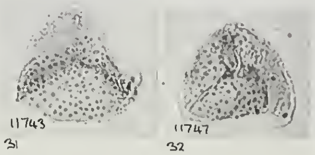
○ HKr.



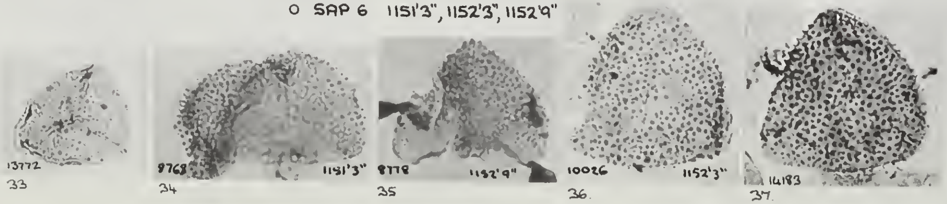
○ SAP 6 1133'



○ UC 608 1262'

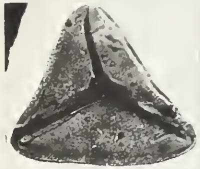


○ SAP 6 1151'3", 1152'3", 1152'9"



Microbaculispora trisina (Balme + Henn.'56) comb. nov. / Microbaculispora gondwanensis Bharad.'62
pl. 51(1-18) pl. 52(1-20)

: UC 678 30,6, 31,6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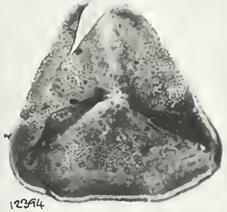
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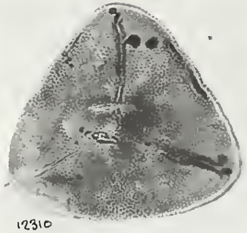
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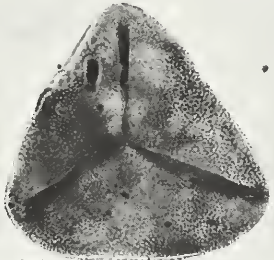
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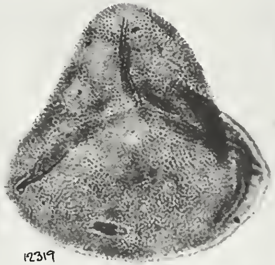
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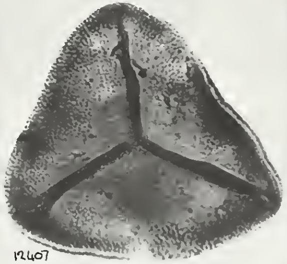
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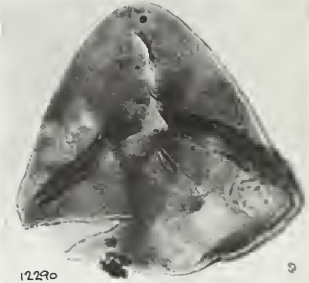
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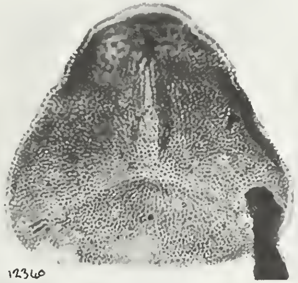
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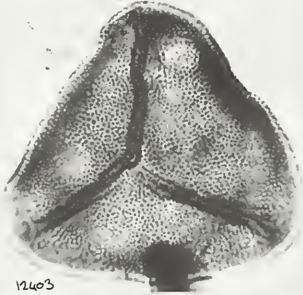
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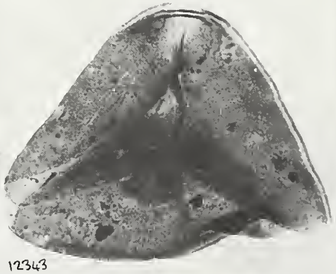
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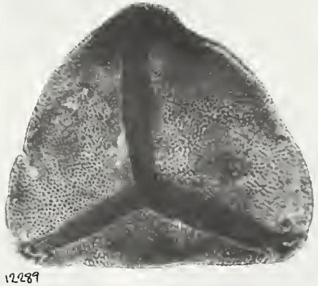
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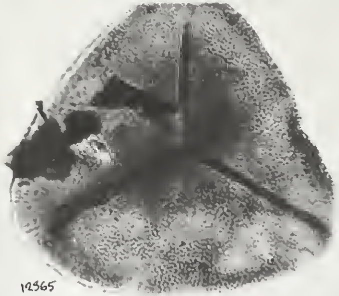
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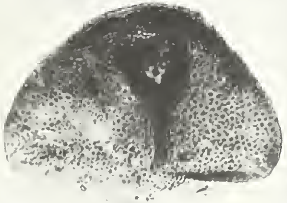
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19
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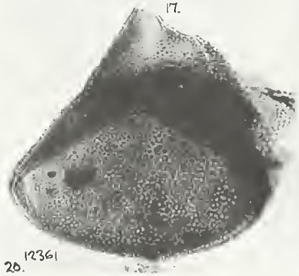

20. 12361
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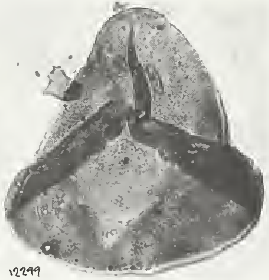
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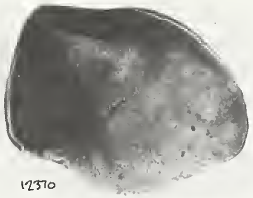
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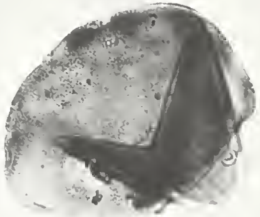
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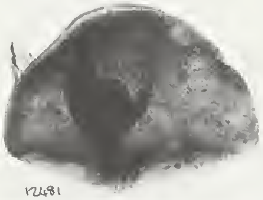
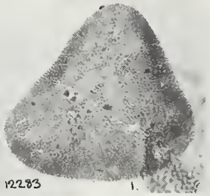

12481
18

Microbaculispora trisina (Balme & Henn.'56) comb. nov. / Microbaculispora gondwanensis Bharad.'62
pl. 51 (1-18) pl. 52 (1-20)

UC 678 30,6 , 31,6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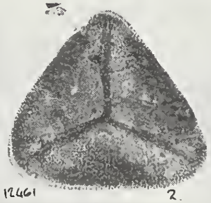
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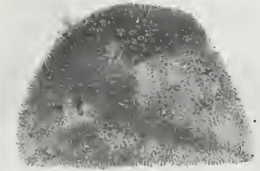
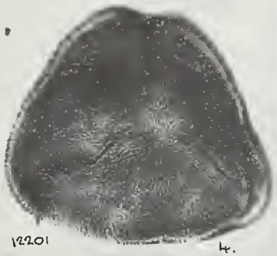

12256 3.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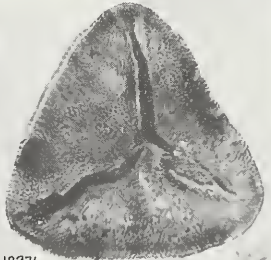
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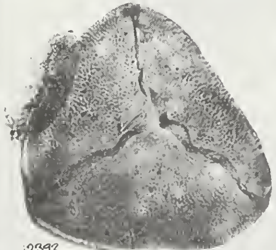
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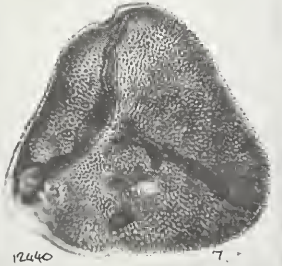
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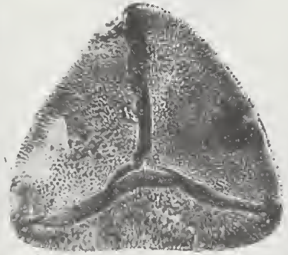
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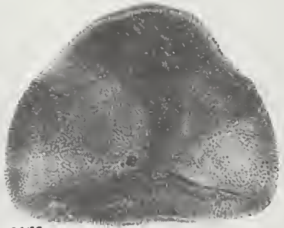
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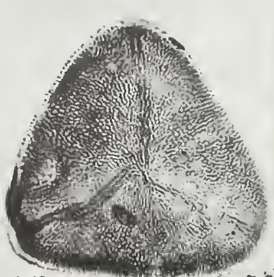
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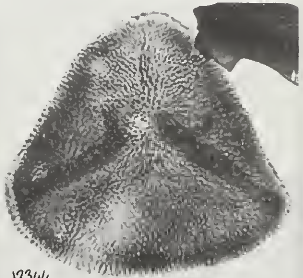
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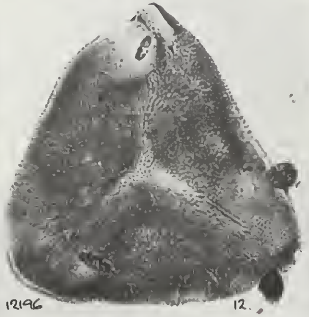
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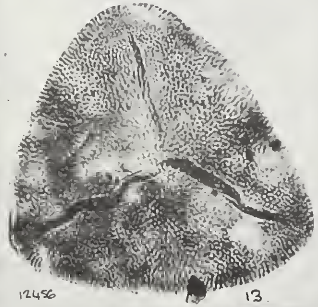
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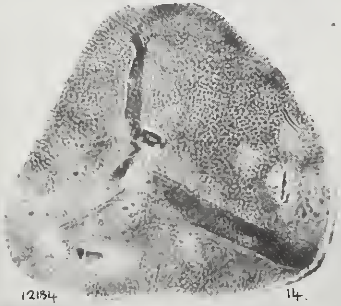
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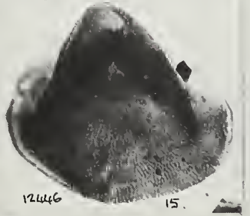
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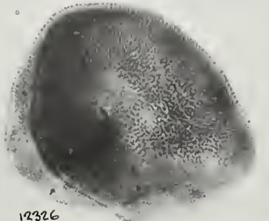
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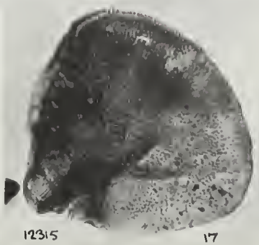
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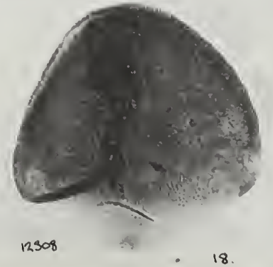
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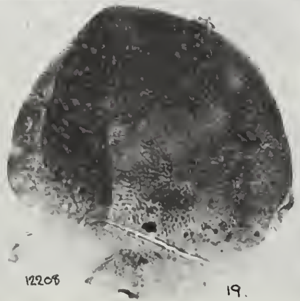
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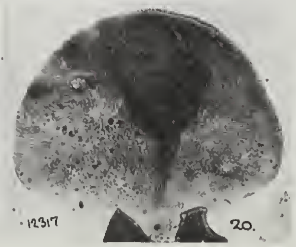
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Microbaculispora trisina (Balme & Henn. '56) comb. nov. / Microbaculispora gondwanensis Bharad. '62
pl. 53 (1-12) pl. 53 (13-24)

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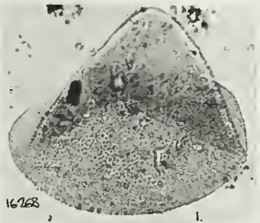
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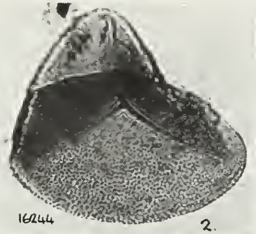
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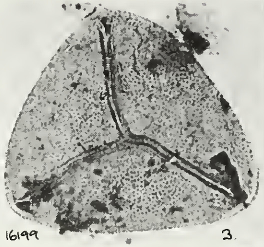
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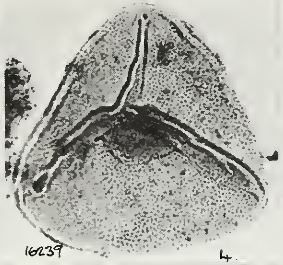
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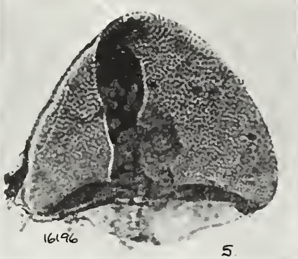
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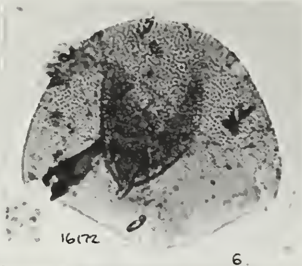
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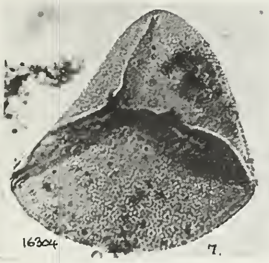
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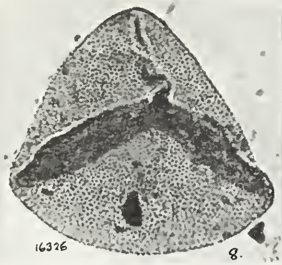
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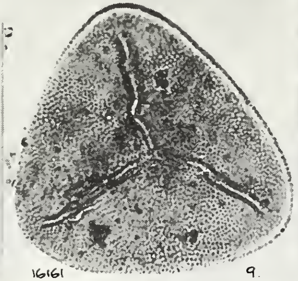
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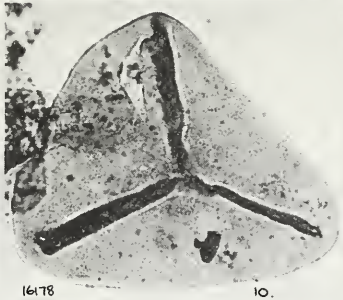
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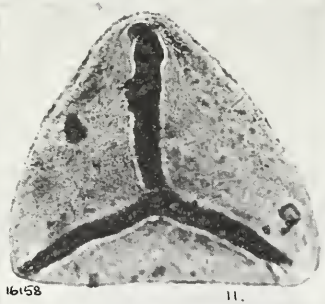
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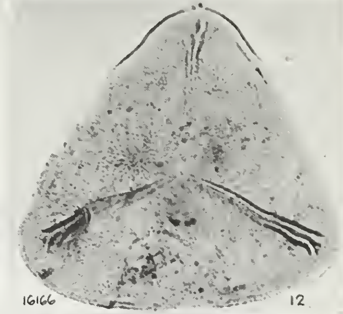
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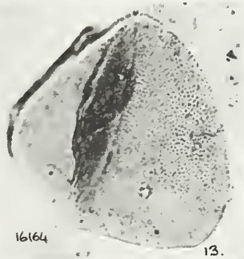
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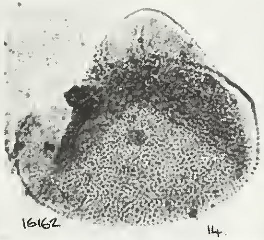
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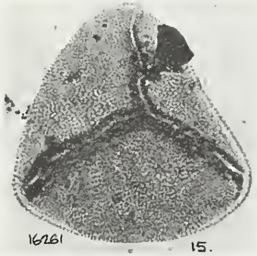
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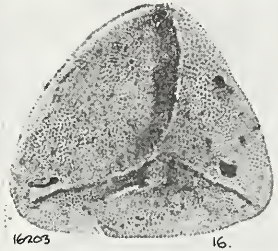
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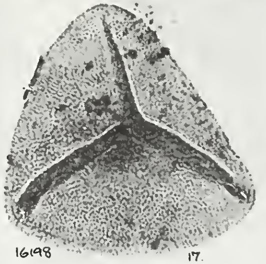
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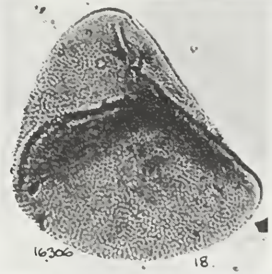
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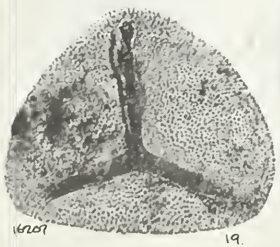
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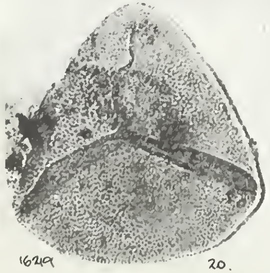
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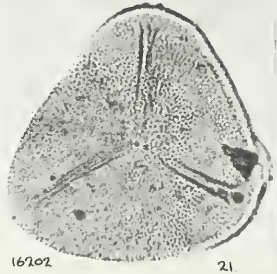
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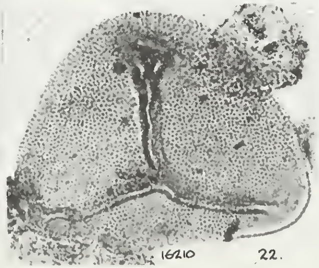
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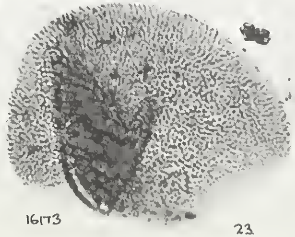
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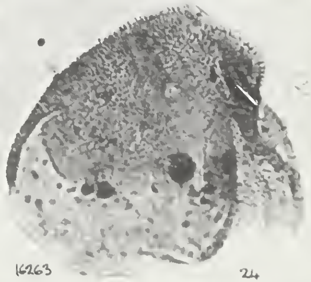
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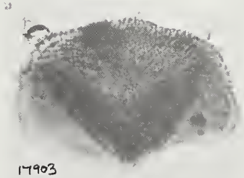
Microbaculispora villosa (Balme + Henn.'56) Bharad.'62

● SAP 7 338'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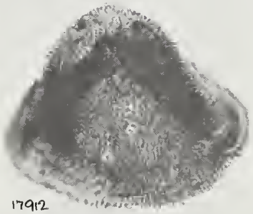
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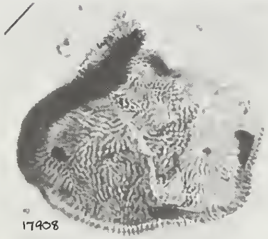
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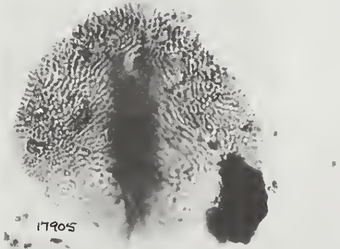
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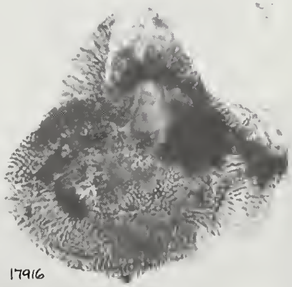
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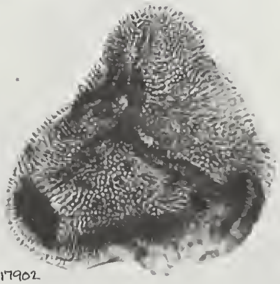
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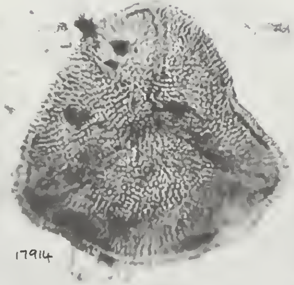
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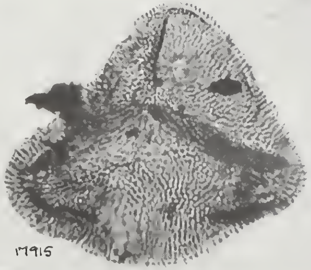
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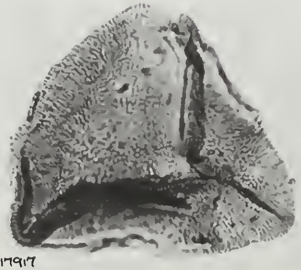
○ SAP 7 464'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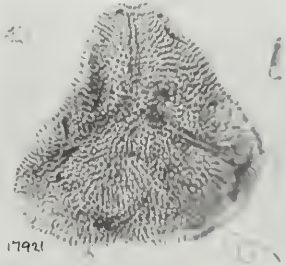
○ SAP 6 521'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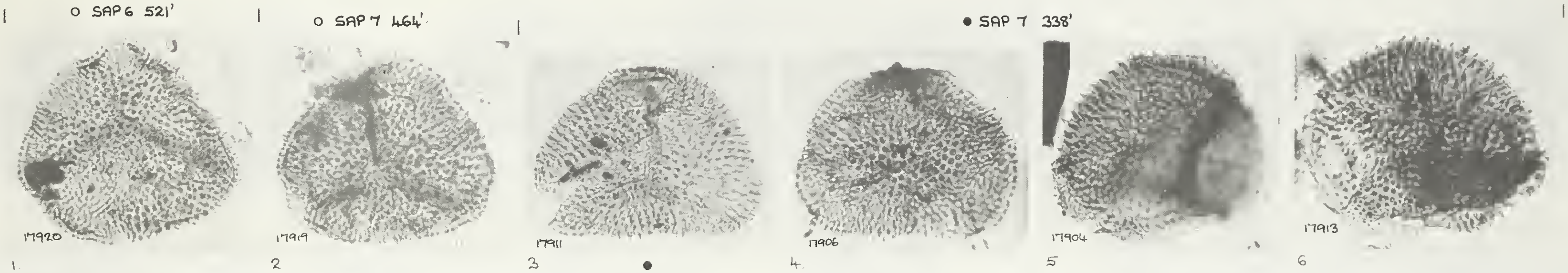
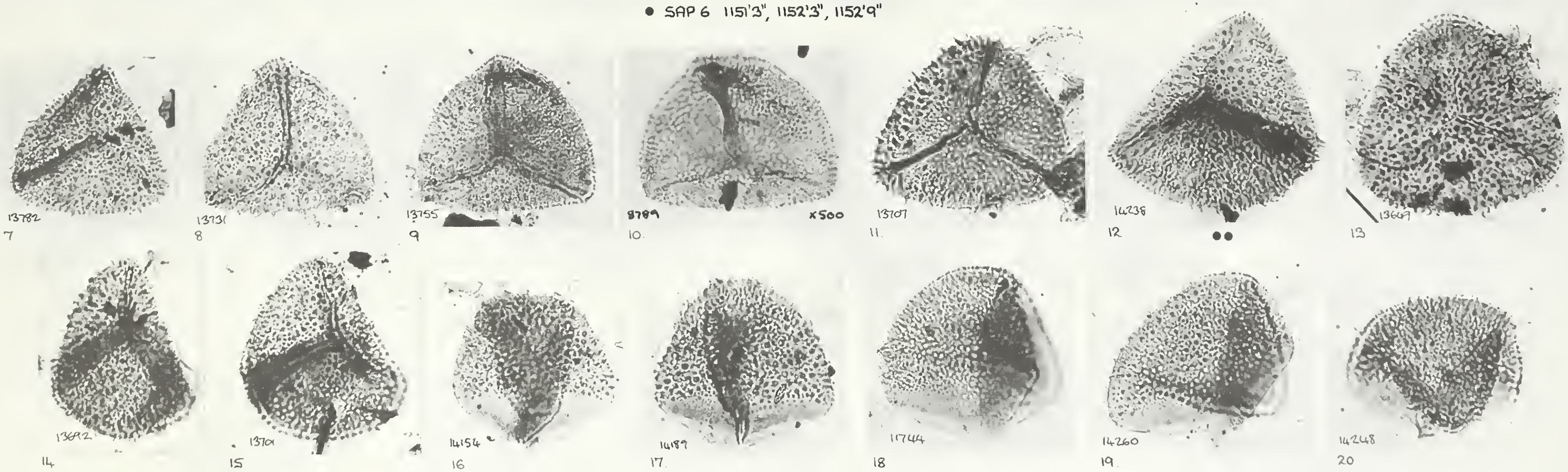
Microbaculispora ericiana (Balme & Henn. '56) comb. nov.

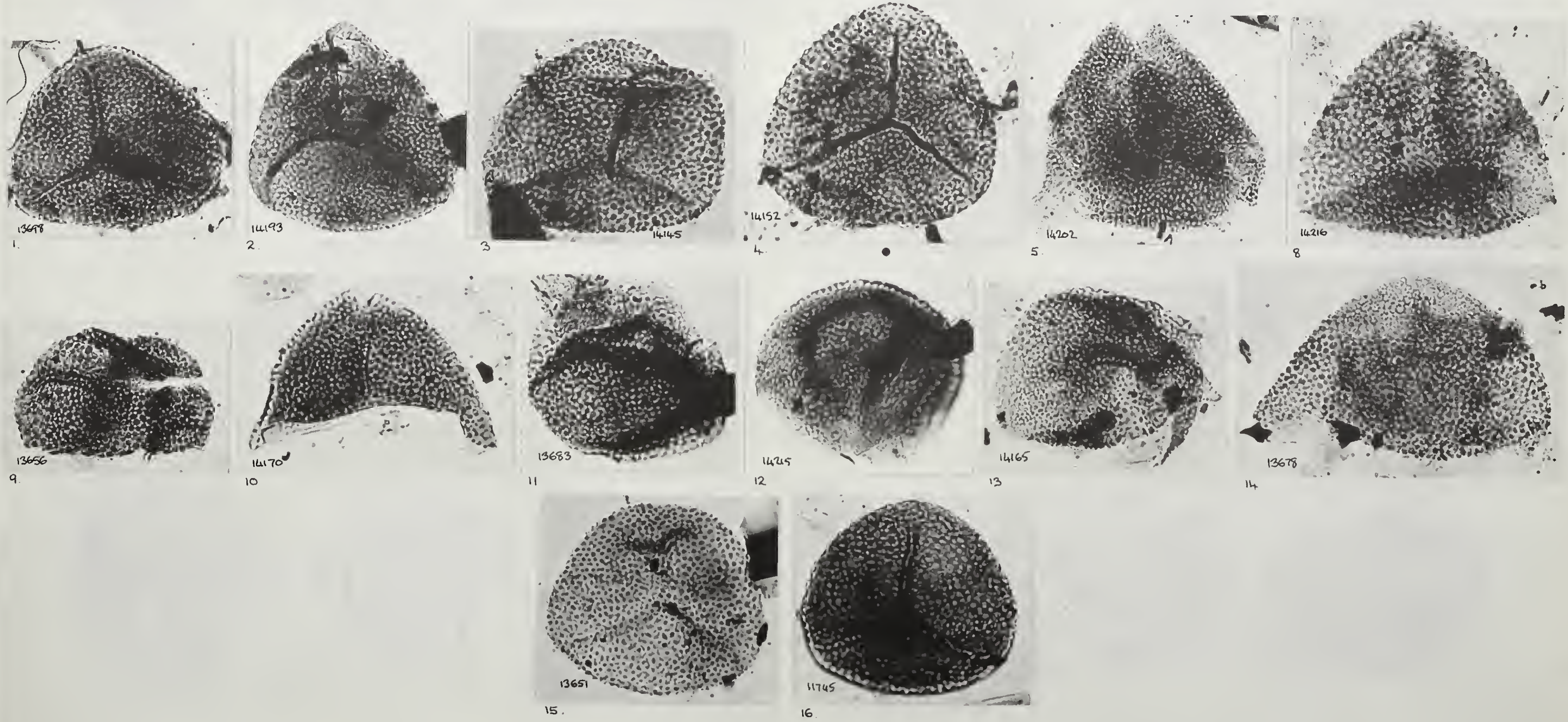


Microbaculispora eoericiana sp. nov.



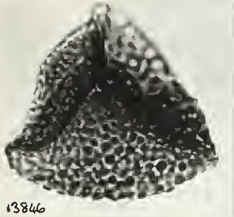
Microbaculispora pseudoreticulata (Balme & Henn.'56) comb.nov.

● SAP 6 1151'3", 1152'3", 1152'9"



Microbaculispora naumovae (Hart '63) comb. nov.

● SAP 6 1130', 1133'



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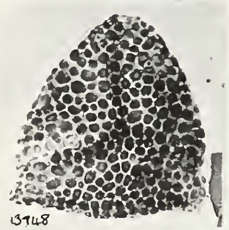

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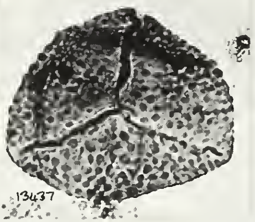

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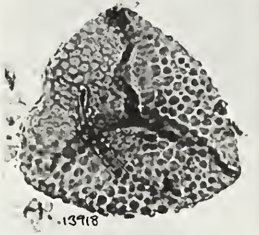

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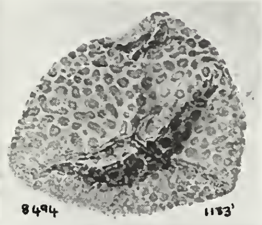

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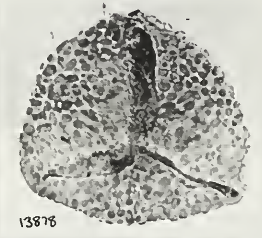

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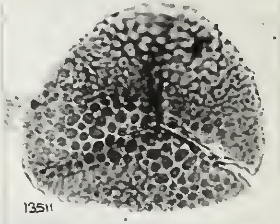

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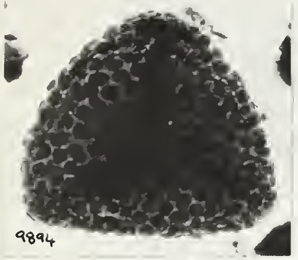

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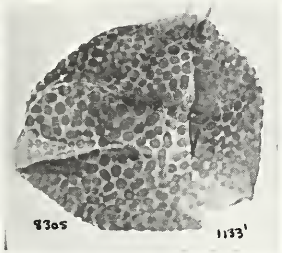

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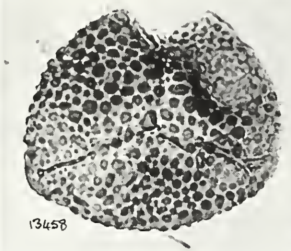

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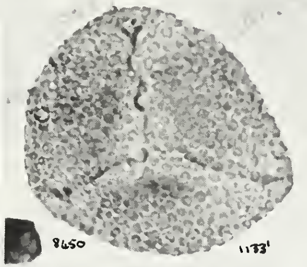

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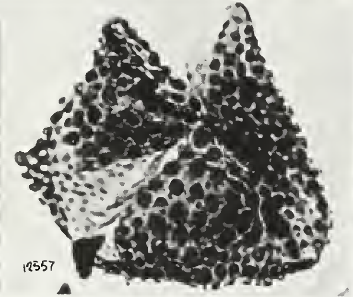

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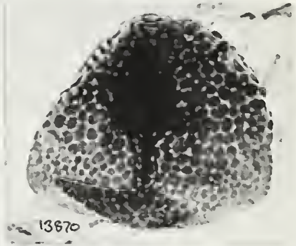

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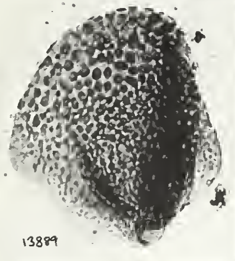

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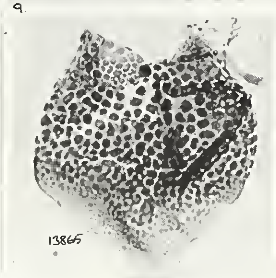

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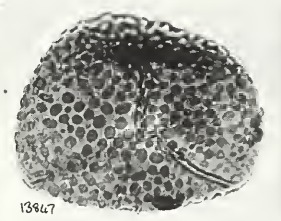

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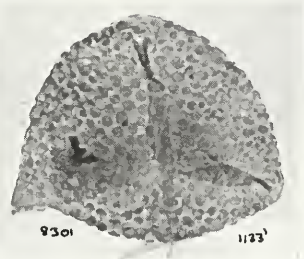

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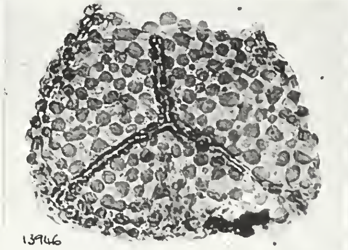

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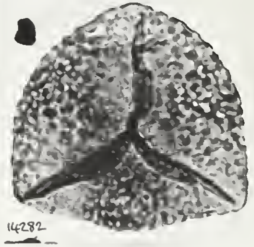

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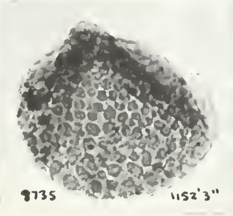

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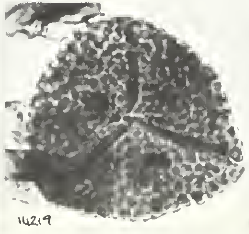

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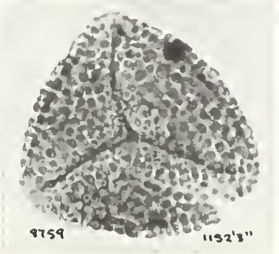

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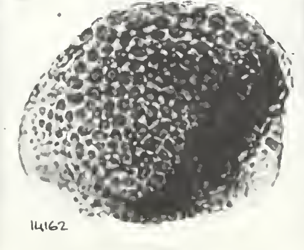

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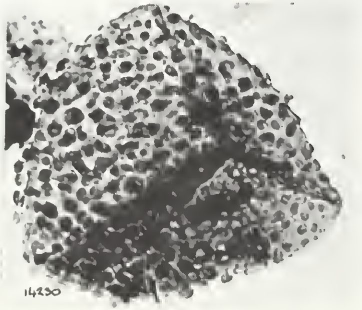

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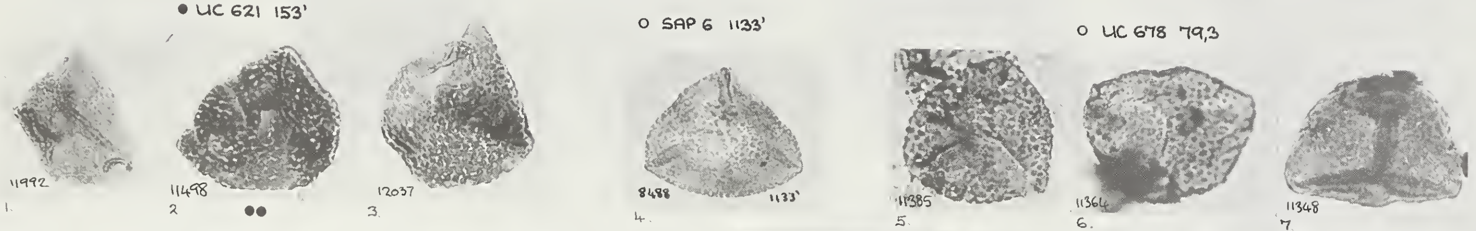
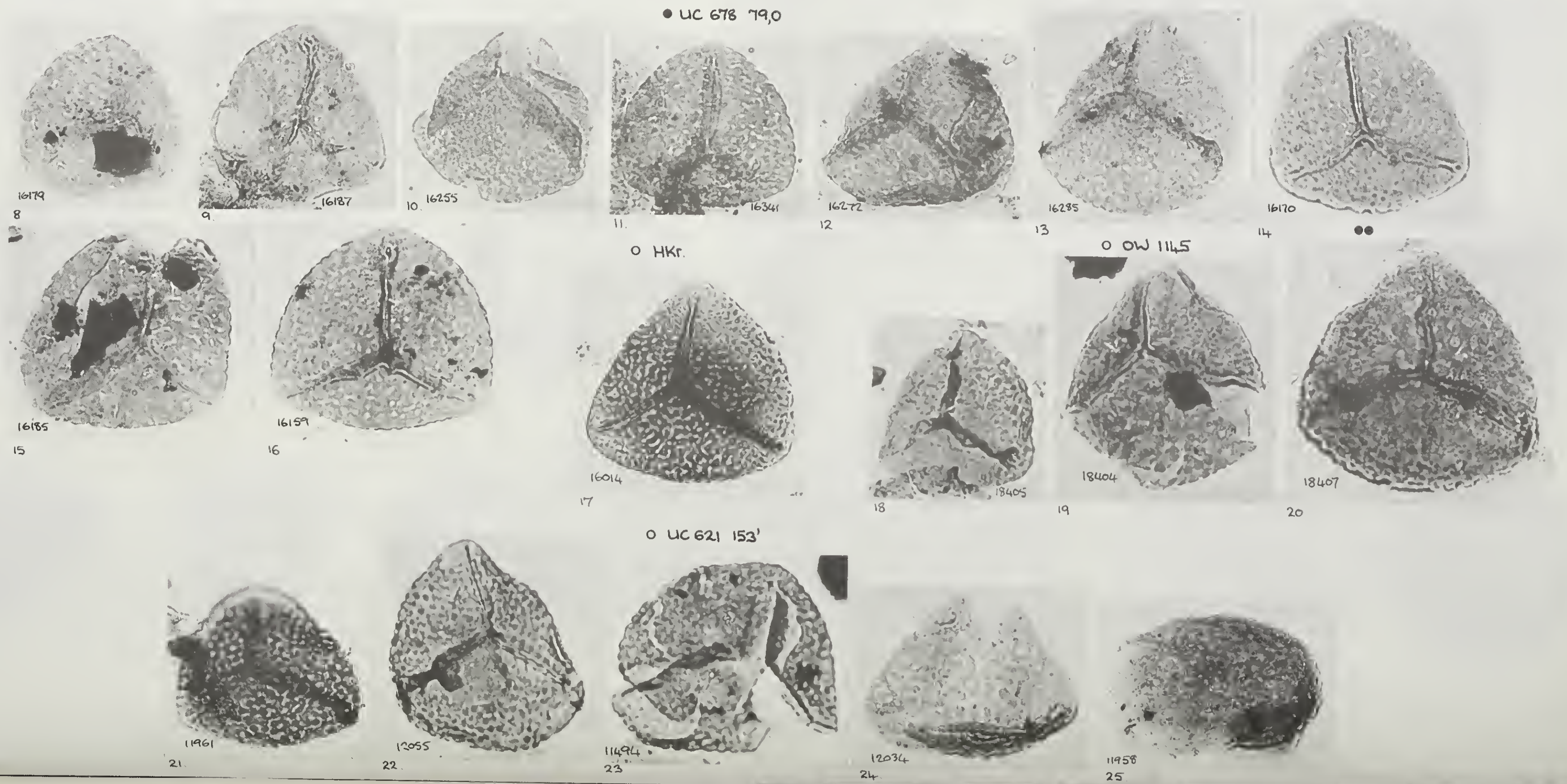
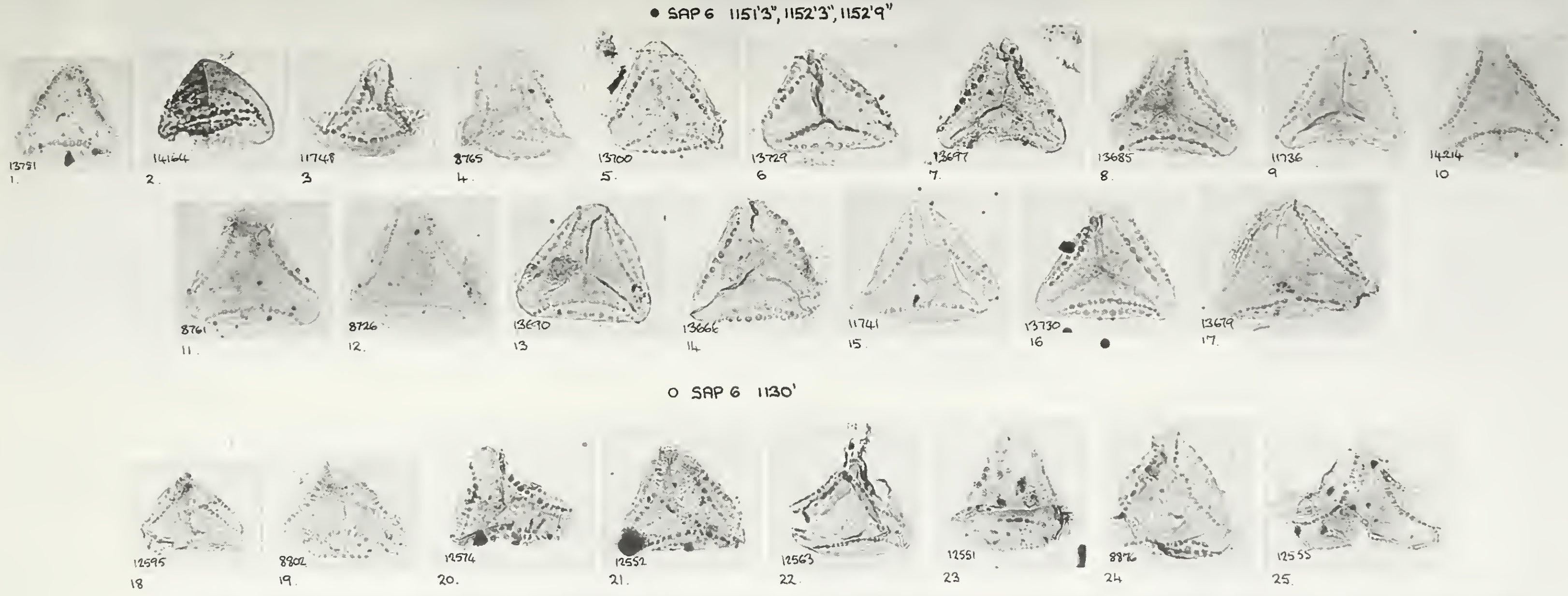
Microbaculispora pentagonalis sp.nov.



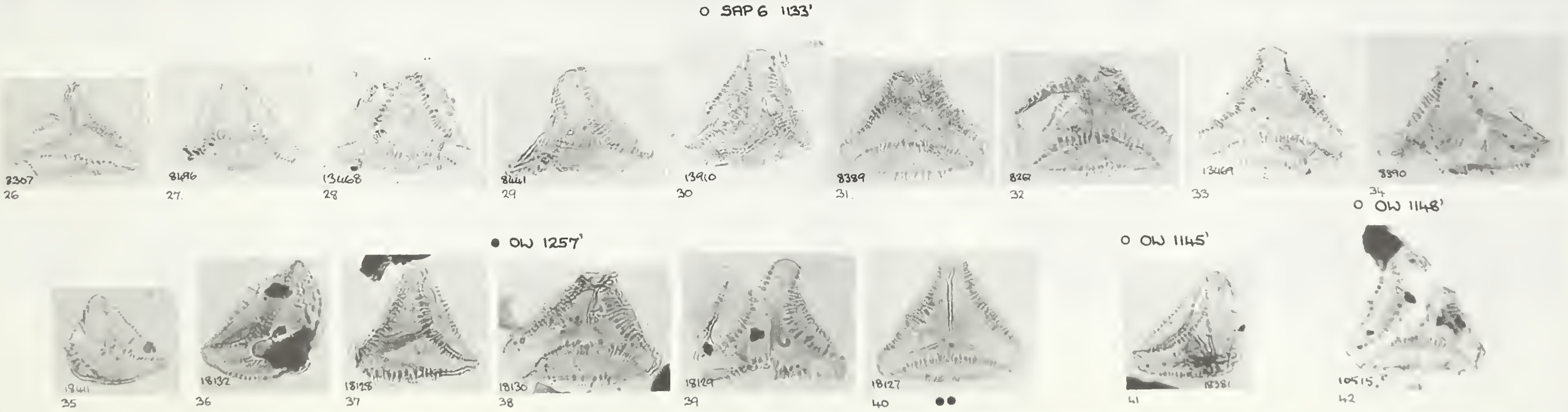
Microbaculispora irregularis sp.nov.



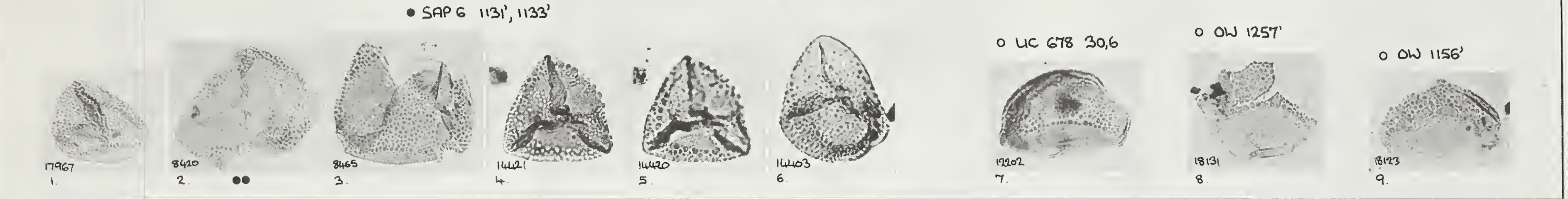
Microbaculispora plumsteadi (Hart '63) comb. nov.



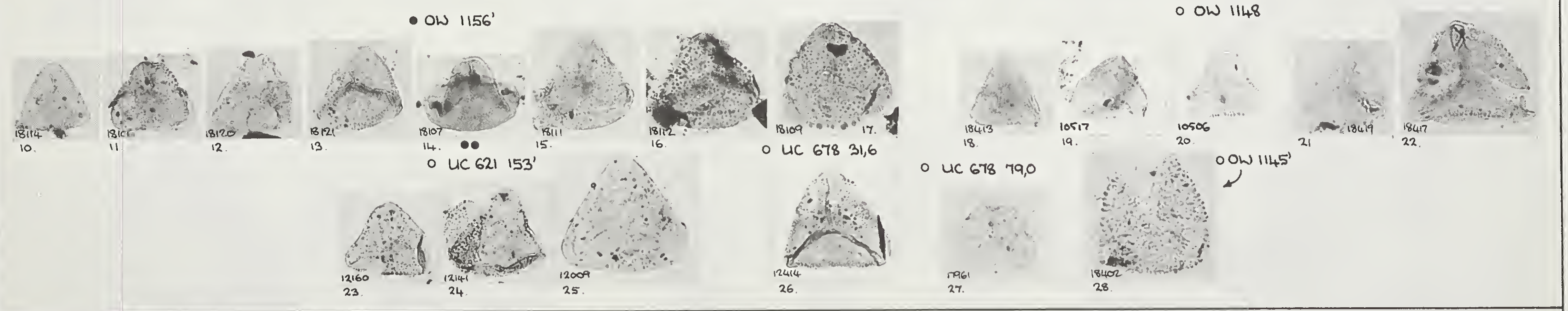
Microbaculispora Lageniformis sp. nov.



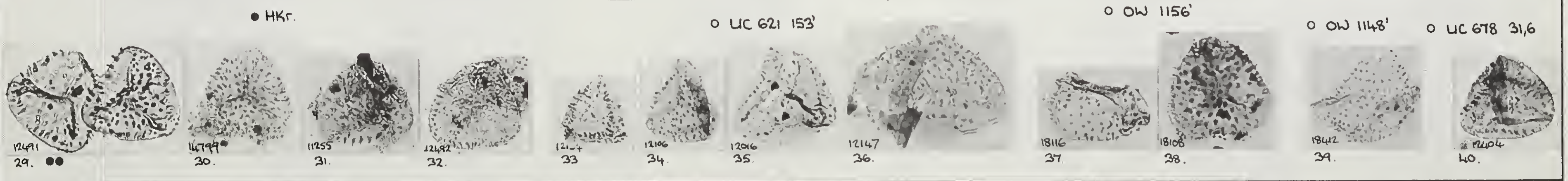
Microbaculispora paramicronodosa sp.nov.



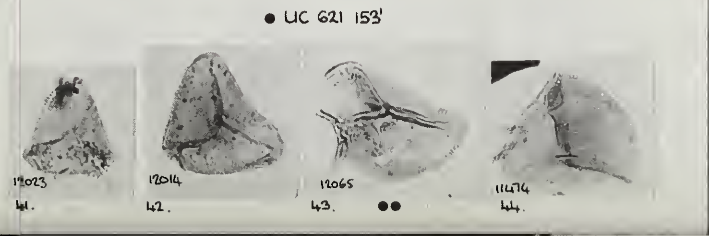
Microbaculispora paratentula sp.nov.



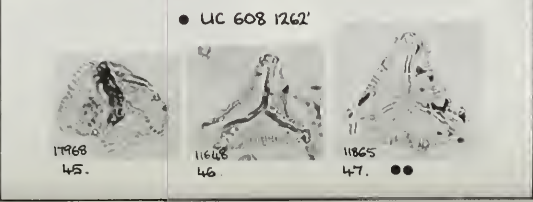
Microbaculispora spinosa sp. nov.



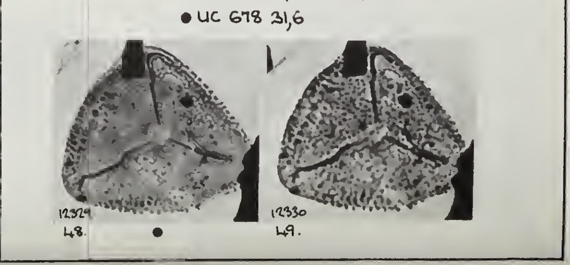
Microbaculispora capilliformis sp.nov.



Microbaculispora digitiformis sp.nov.

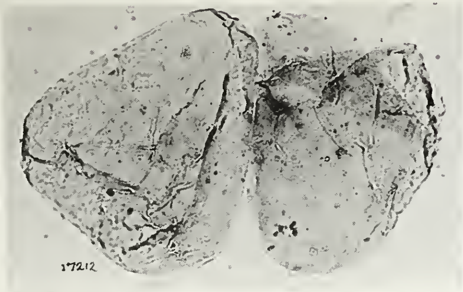


Microbaculispora sp. A.



Gracilispora membranosa gen. et. sp. nov.

● HKr.



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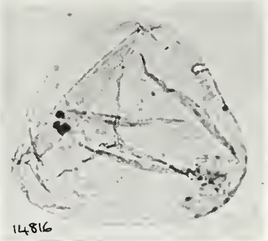

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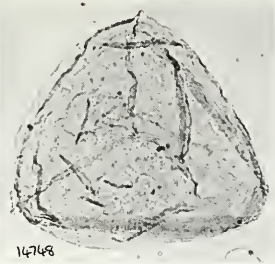

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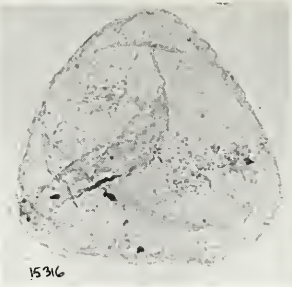

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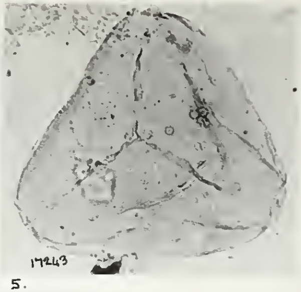

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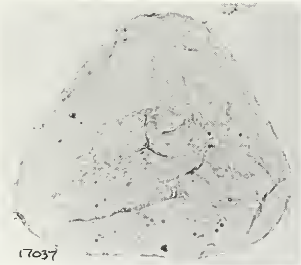

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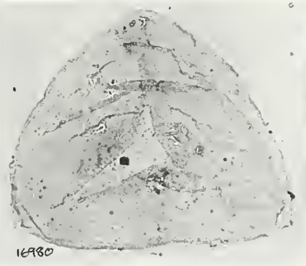

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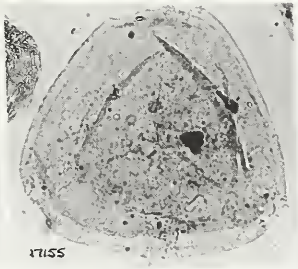

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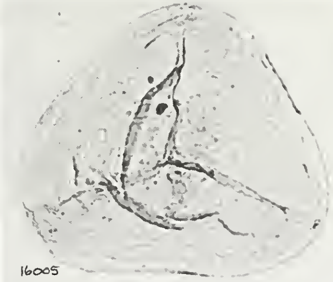

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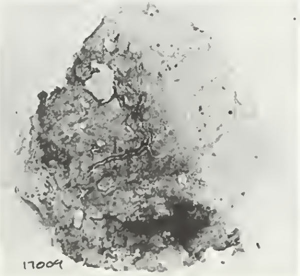

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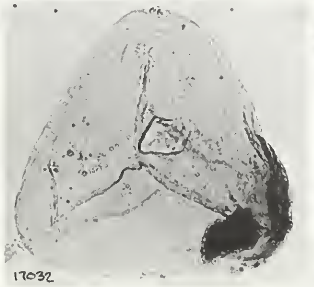

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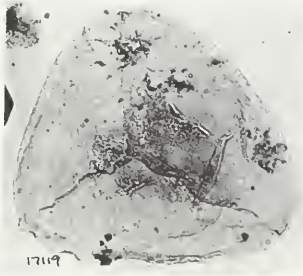

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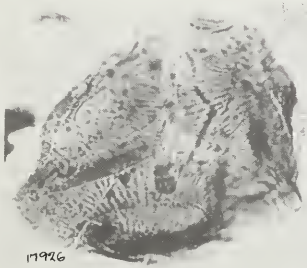
Dulhuntyispora dulhuntyi Pot '56

● SAP 7 464'



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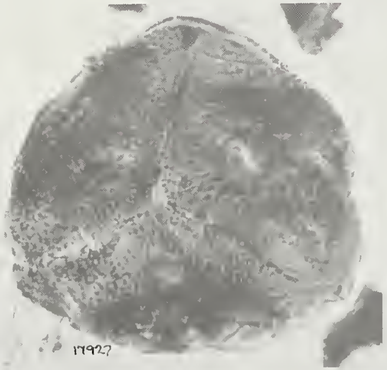

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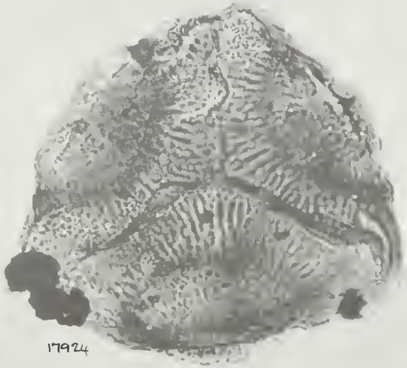

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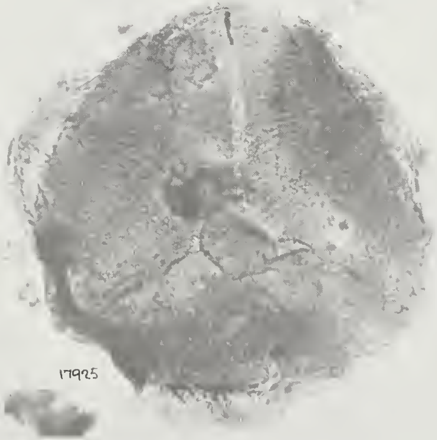

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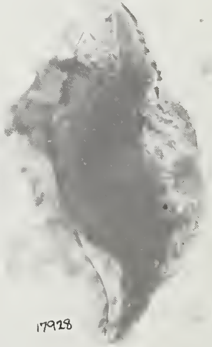

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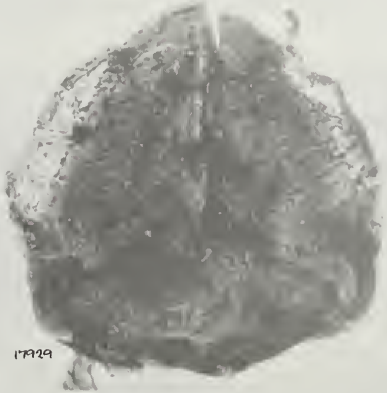
○ SAP 7 338'

○ SAP 6 521'



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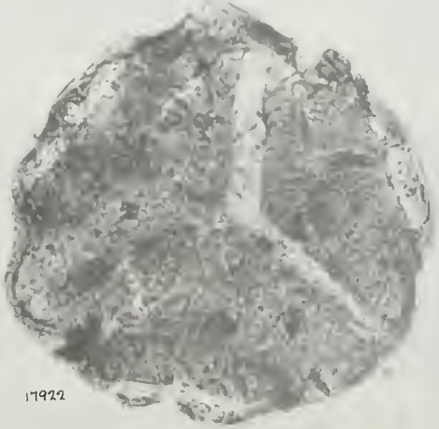

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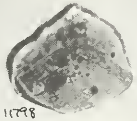
Pachytriletes densus Bose + Kar '66

● UC 608 1262'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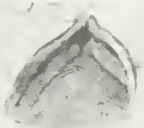
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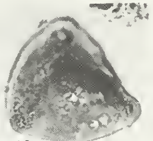
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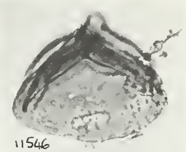
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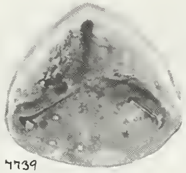
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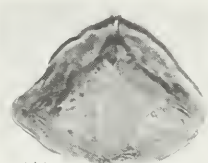
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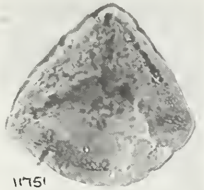
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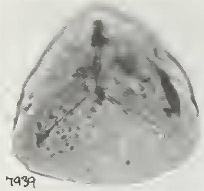
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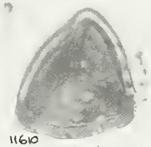
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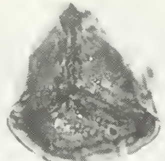
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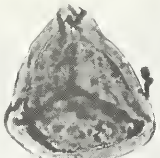
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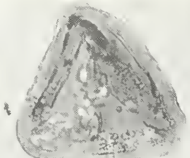
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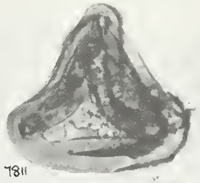
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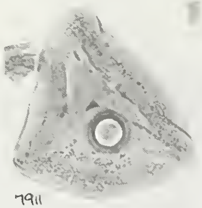
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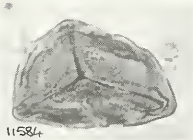
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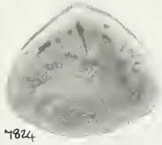
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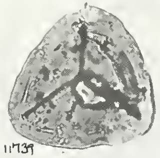
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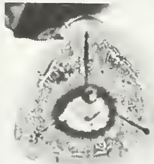
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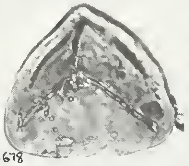
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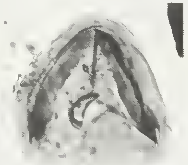
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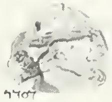
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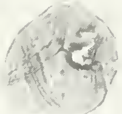
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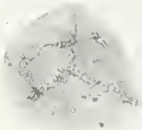
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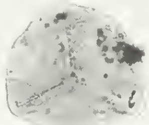
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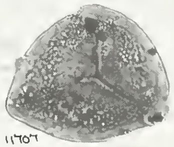
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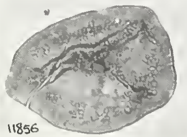
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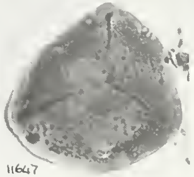
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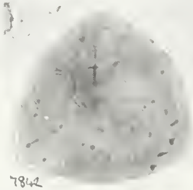
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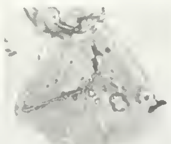
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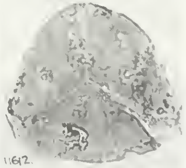
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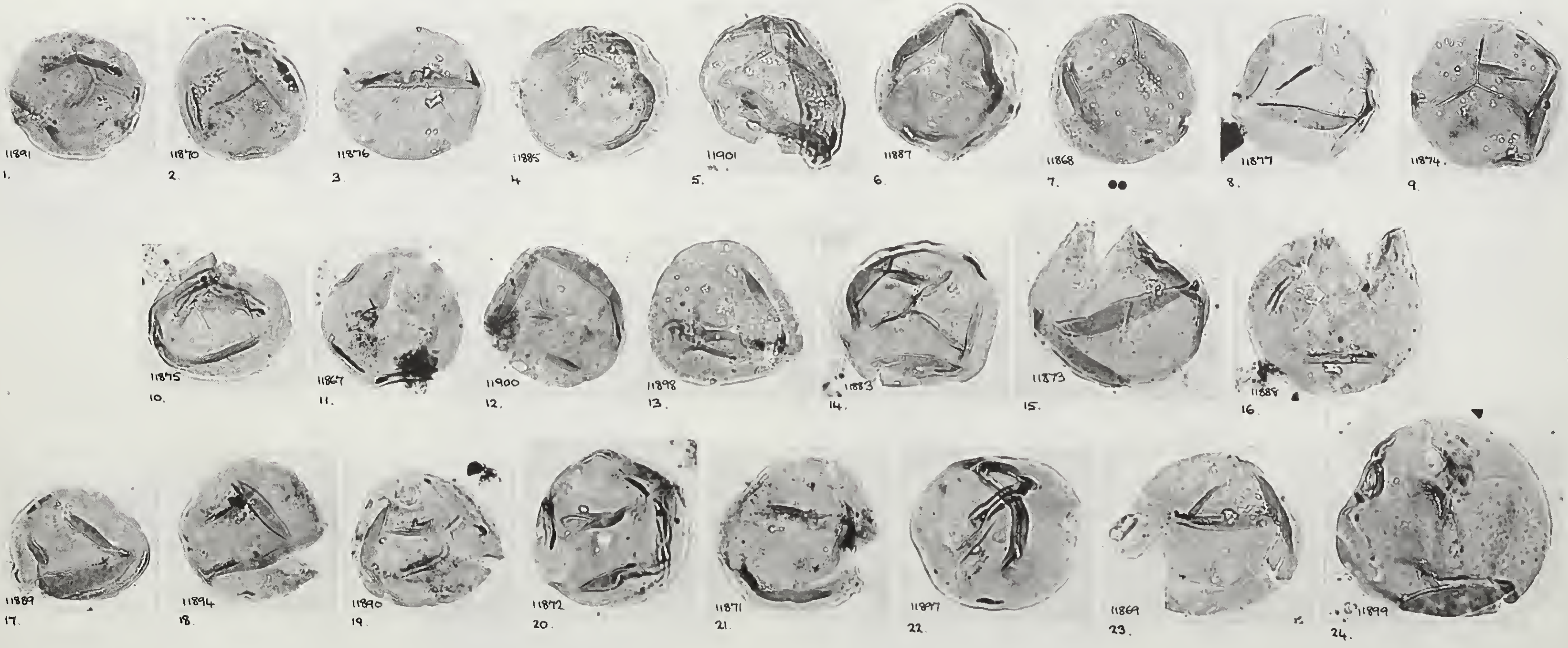
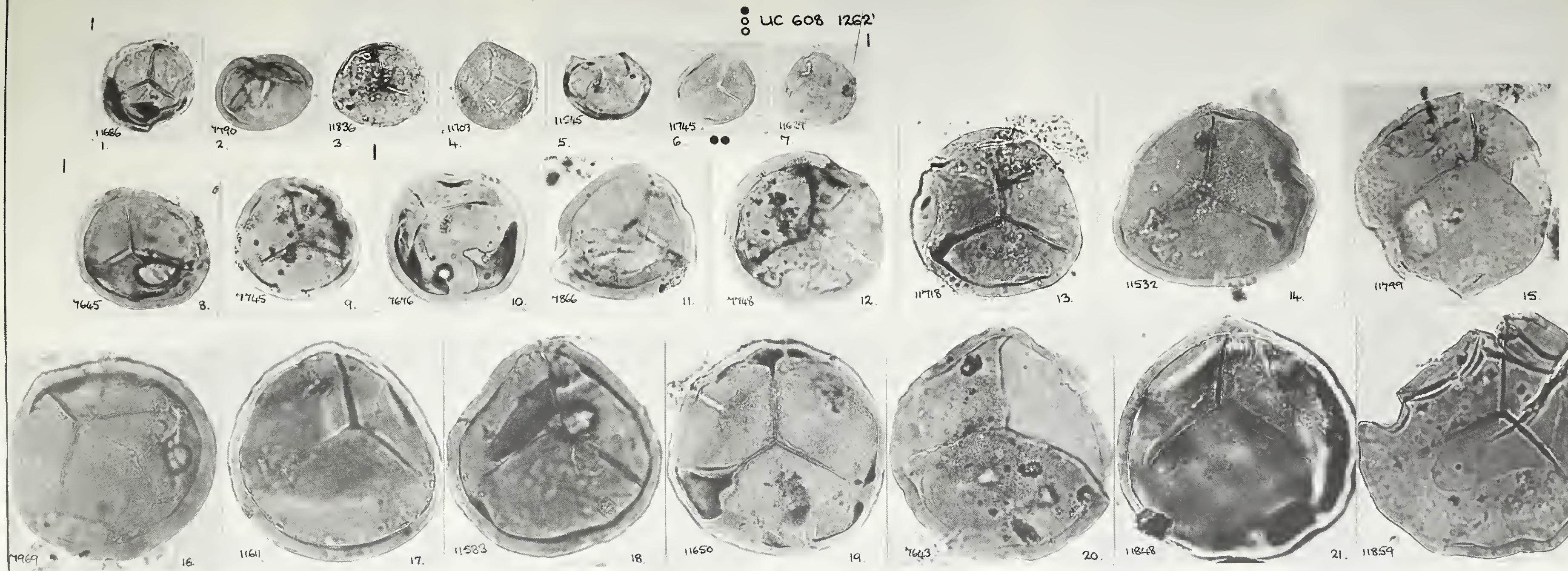
Punctatisporites gracilis sp.nov.

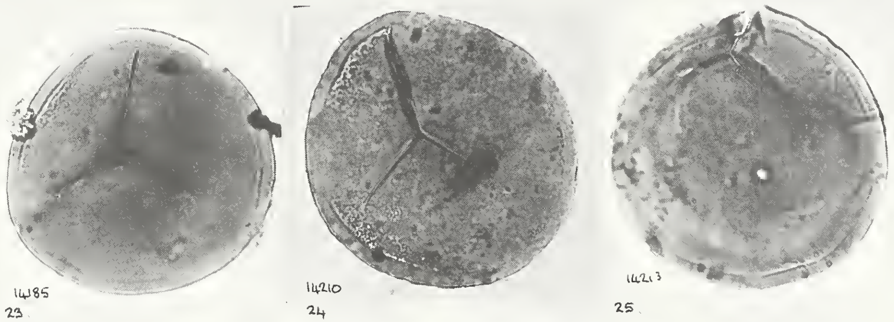
● UC 608 1590'



Punctatisporites parvus sp.nov. / P. medius sp.nov. / P. gretensis Balme + Henn. '56
pl 65 (1-7) pl 65 (8,9) pl. 65 (10-22)

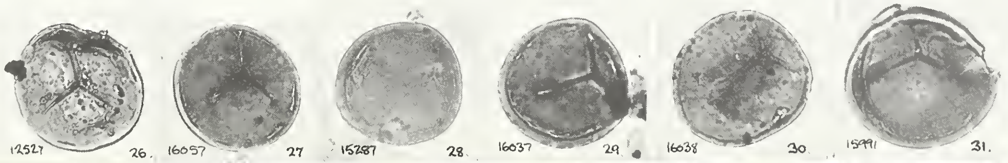


O SAP 6 1152'9"



Punctatisporites gretensis
Balme & Henn. '56.

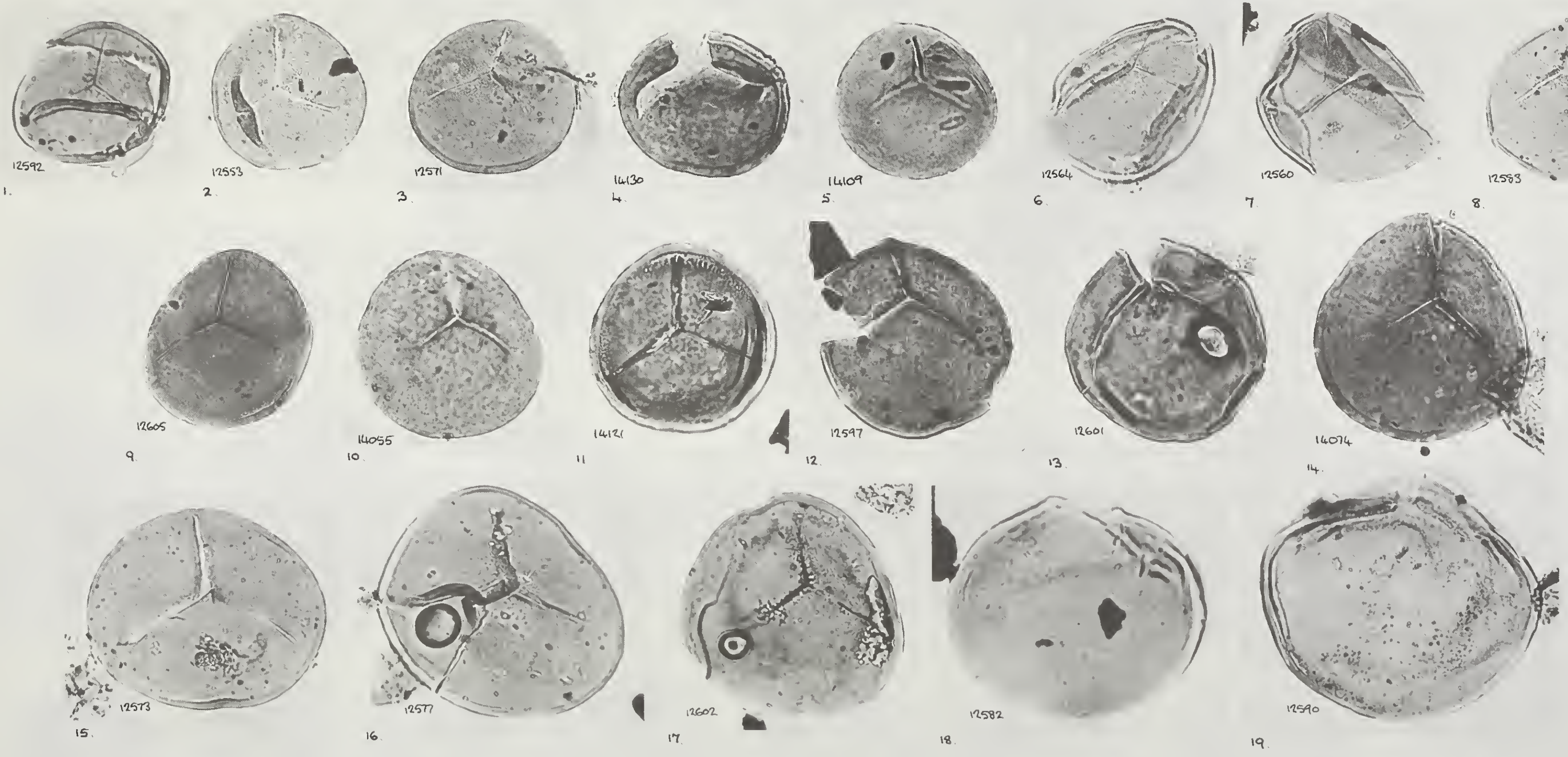
● HKr.



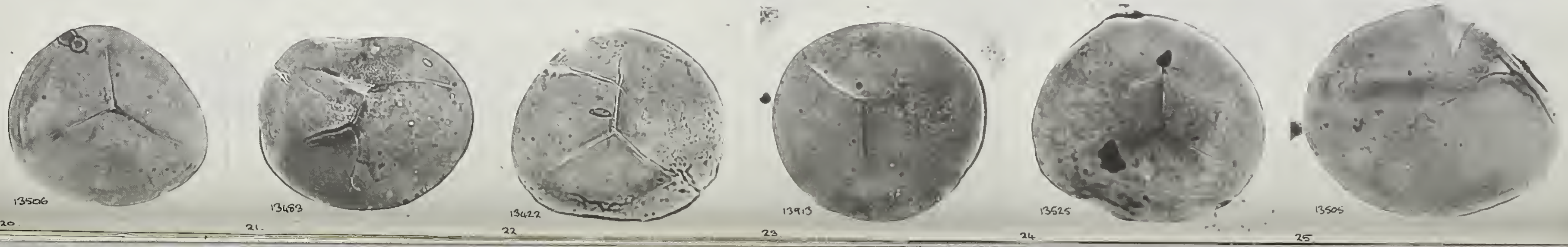
Punctatisporites medius sp.nov.

Punctatisporites gretensis Balme & Henn.'56

● SAP 6 1130'

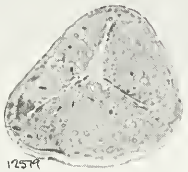


○ SAP 6 1133'



Paucipunctatosporites karrooensis gen. et. sp. nov.

● SAP 6 1130', 1133'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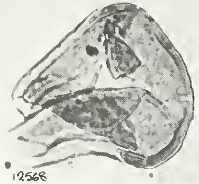
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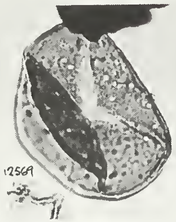
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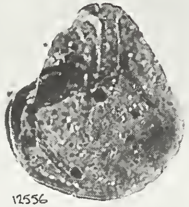
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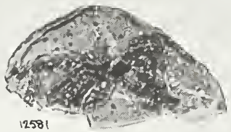
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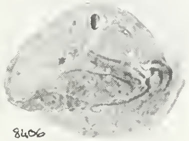
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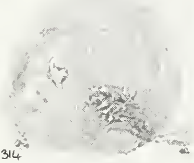
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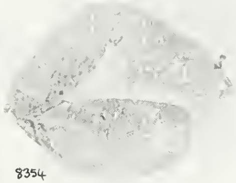
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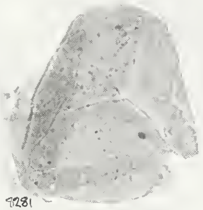
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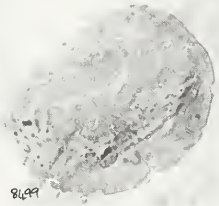
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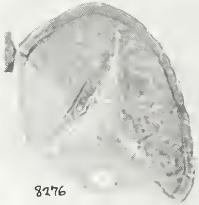
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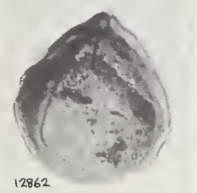
Altitriletes densus Venk.+Kar '68

● WV3 133,50



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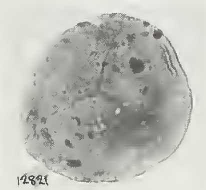

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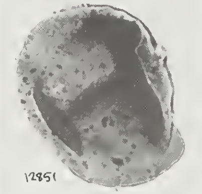

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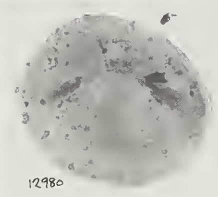

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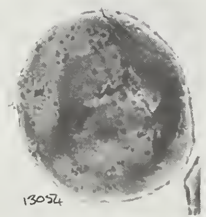

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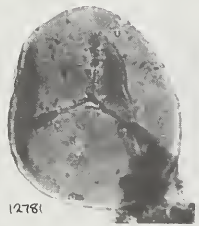

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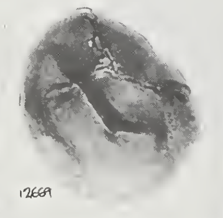

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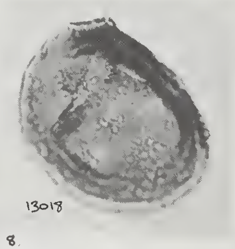

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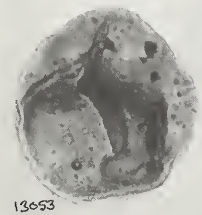

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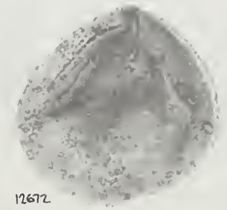

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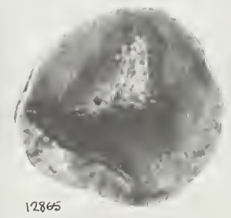

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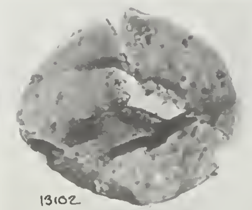

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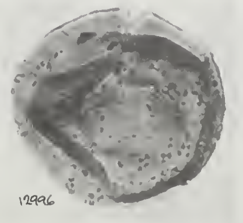

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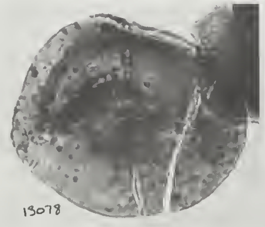

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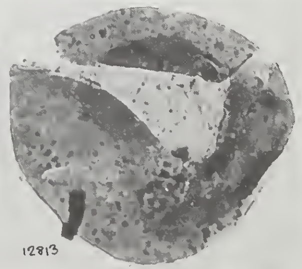
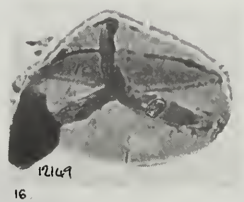


15.

o UC 621 153'



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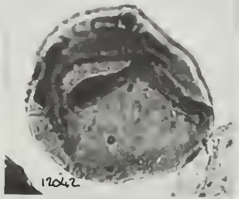

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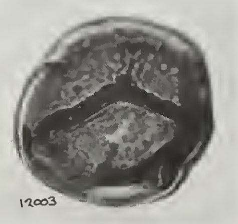

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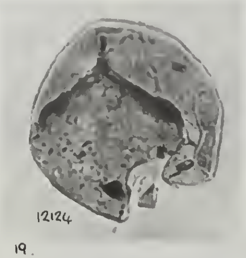

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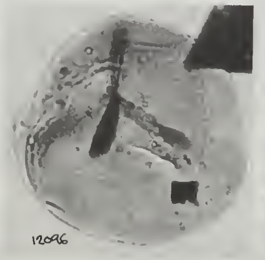

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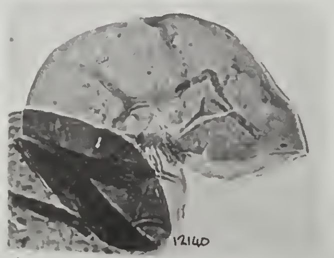
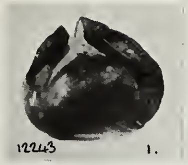


21.

Altitriletes densus Venk.+Kar '68

o UC 678 30,6, 31,6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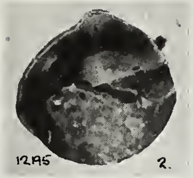
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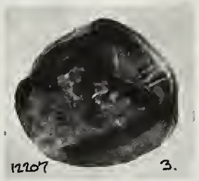
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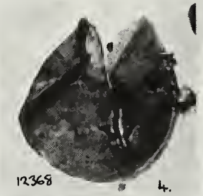
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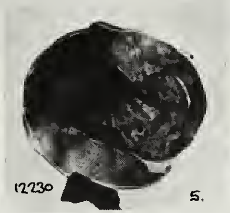
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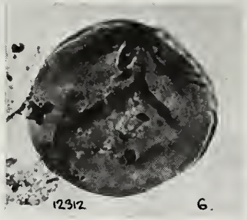
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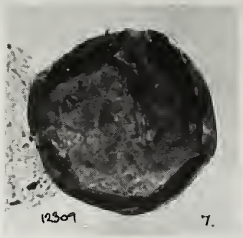
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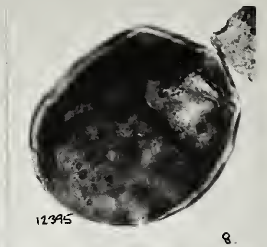
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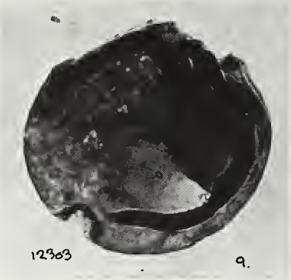
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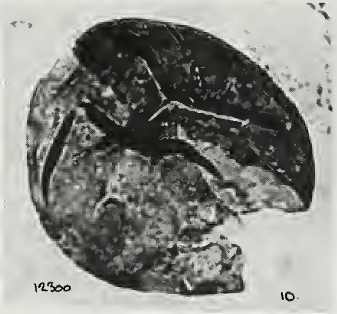
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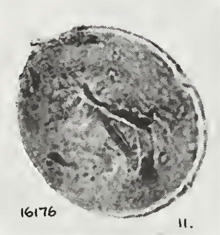
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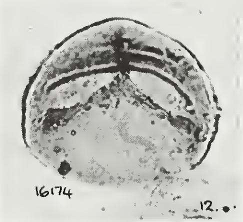
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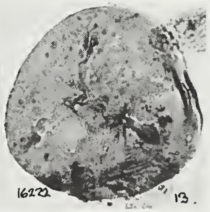
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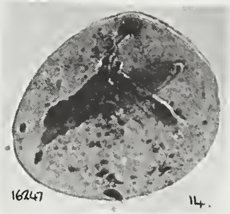
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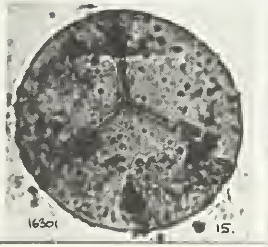
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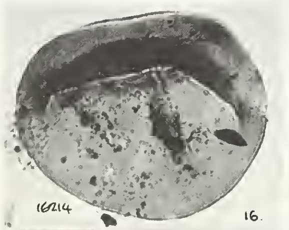
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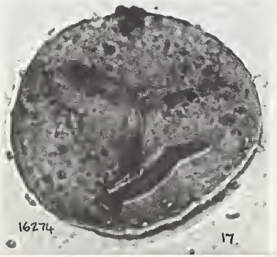
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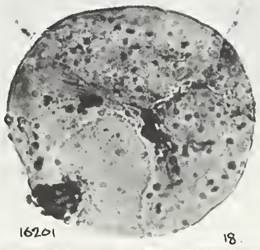
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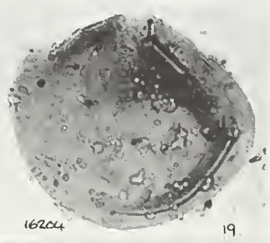
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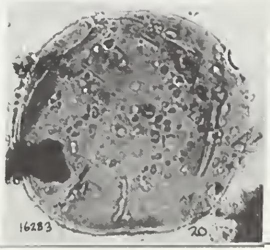
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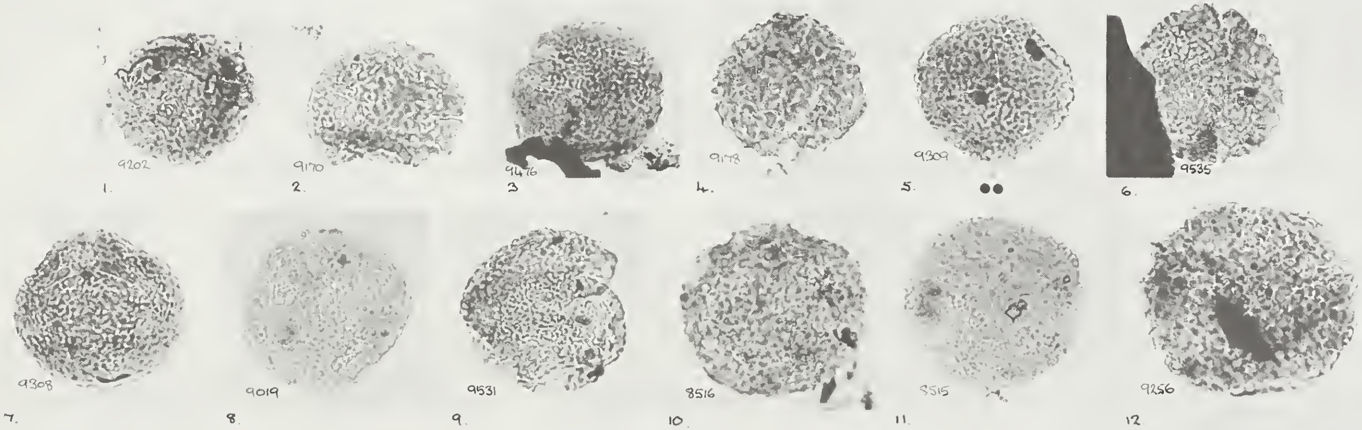
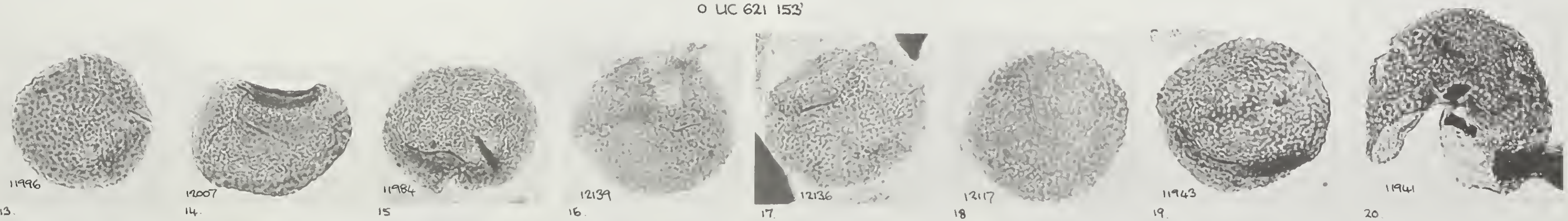
Cyclogranisporites intrareticulatus sp.nov.

● SAP 6 1000', 1007', 1017'



○ UC 621 153'



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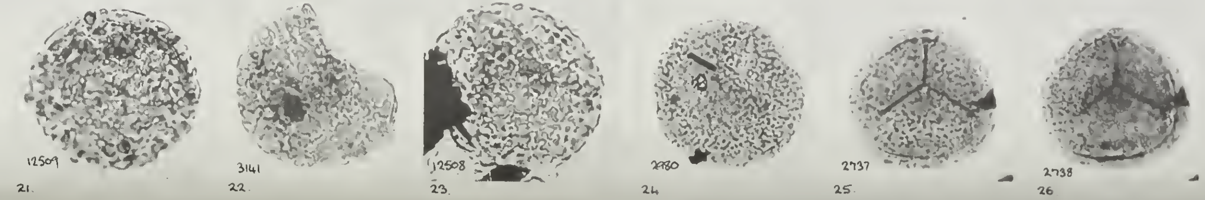
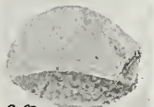


Cyclogranisporites verrucosus sp.nov.

o SAP6 1131', 1133'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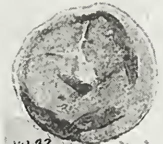
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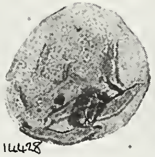
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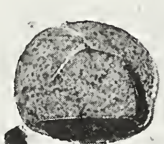
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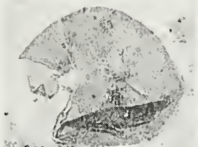
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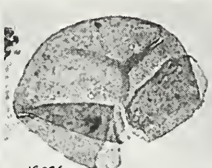
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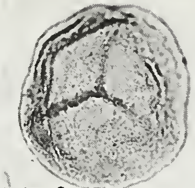
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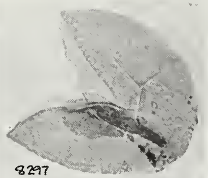
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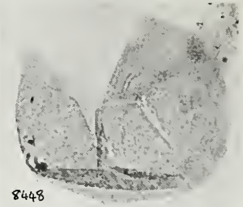
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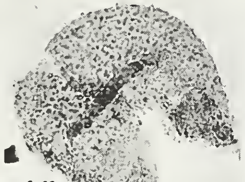
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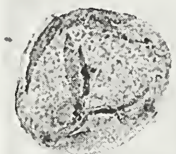
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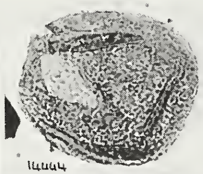
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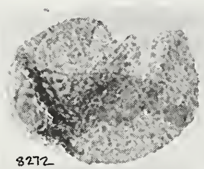
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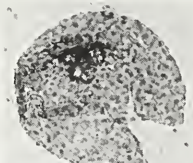
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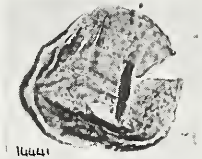
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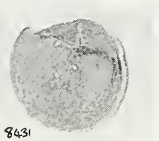
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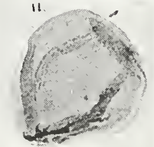
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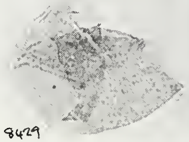
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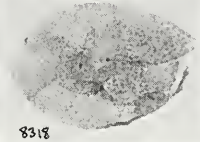
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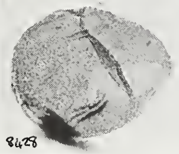
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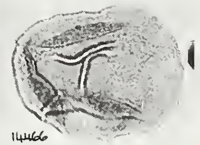
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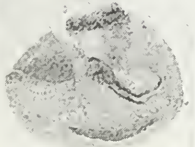
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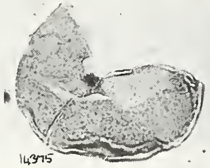
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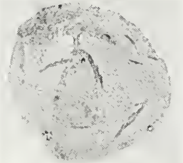
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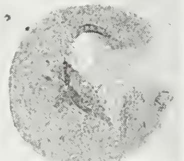
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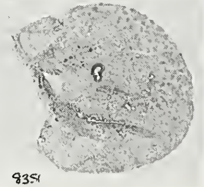
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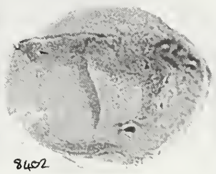
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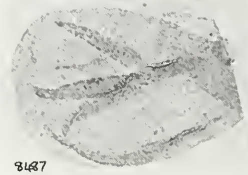
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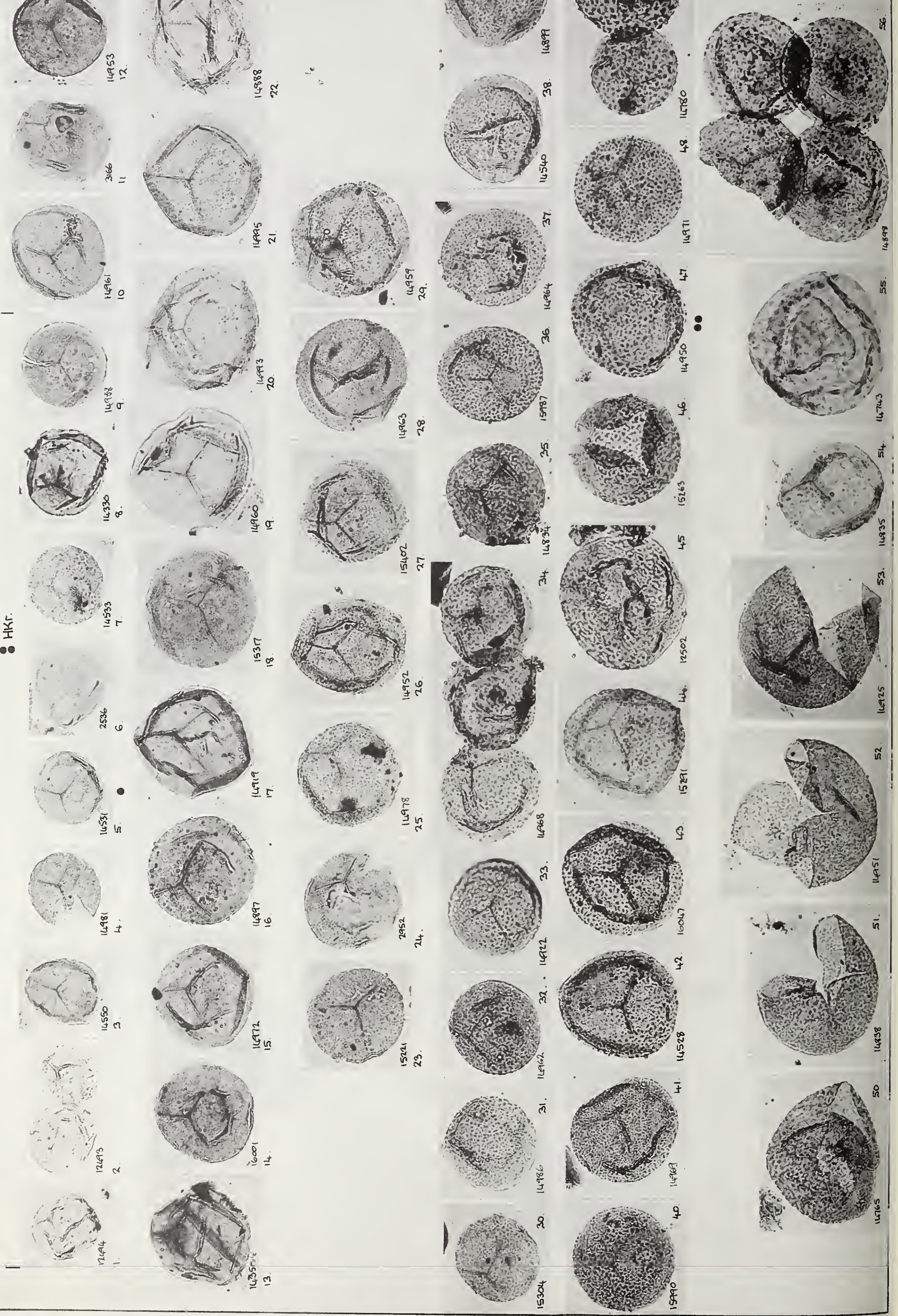
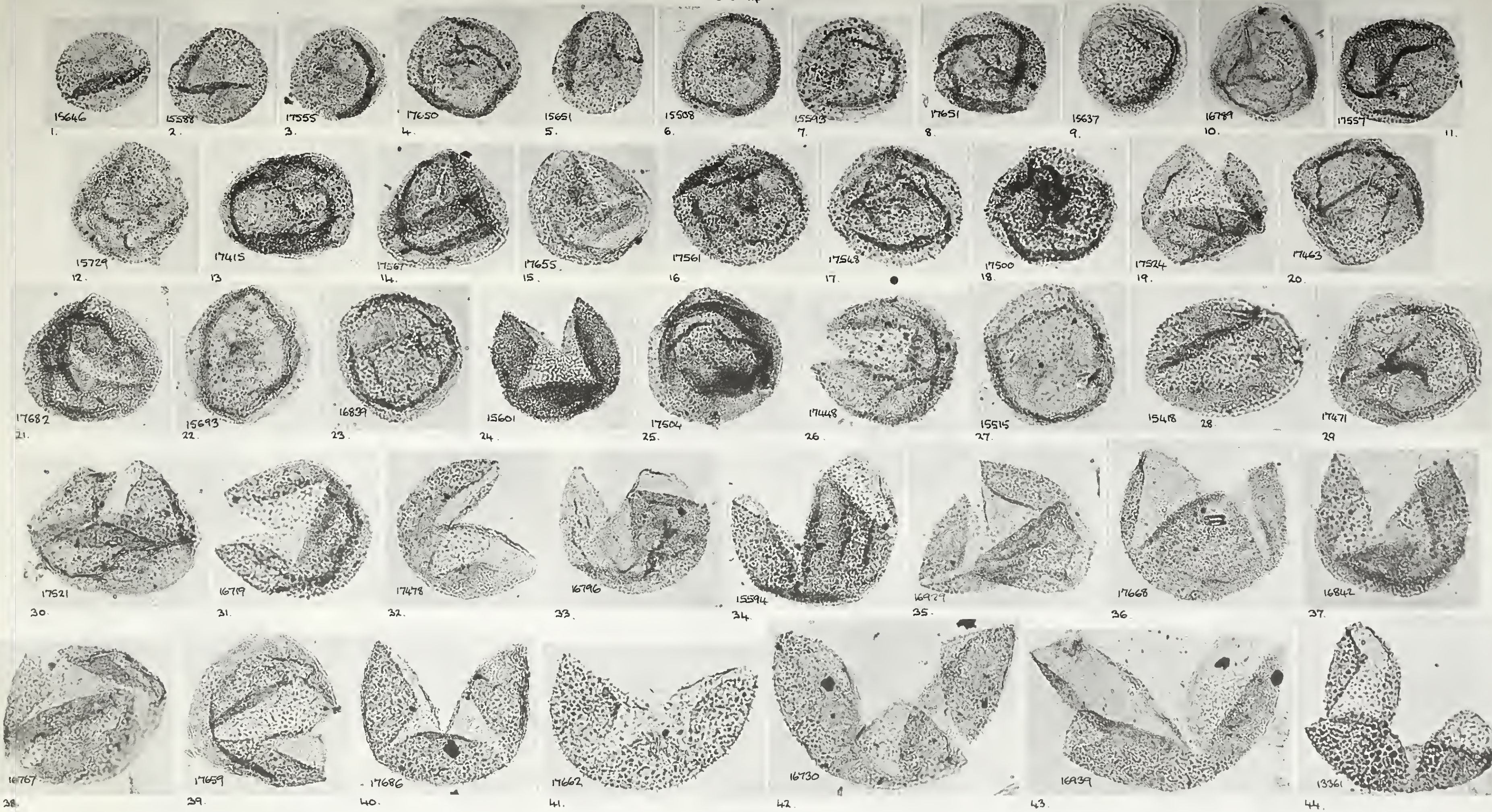
Cyclogranisporites parvus (Lak, Sah, & Dube '60) comb. nov. / C. verrucosus sp. nov.
pl. 72 (1-9) / pl. 72 (10-56)

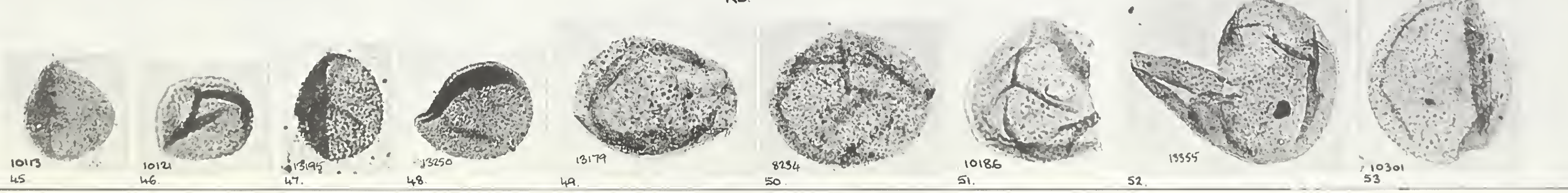


Cyclogranisporites bhardwaji (Hart '63) comb. nov.

● Ow 94'

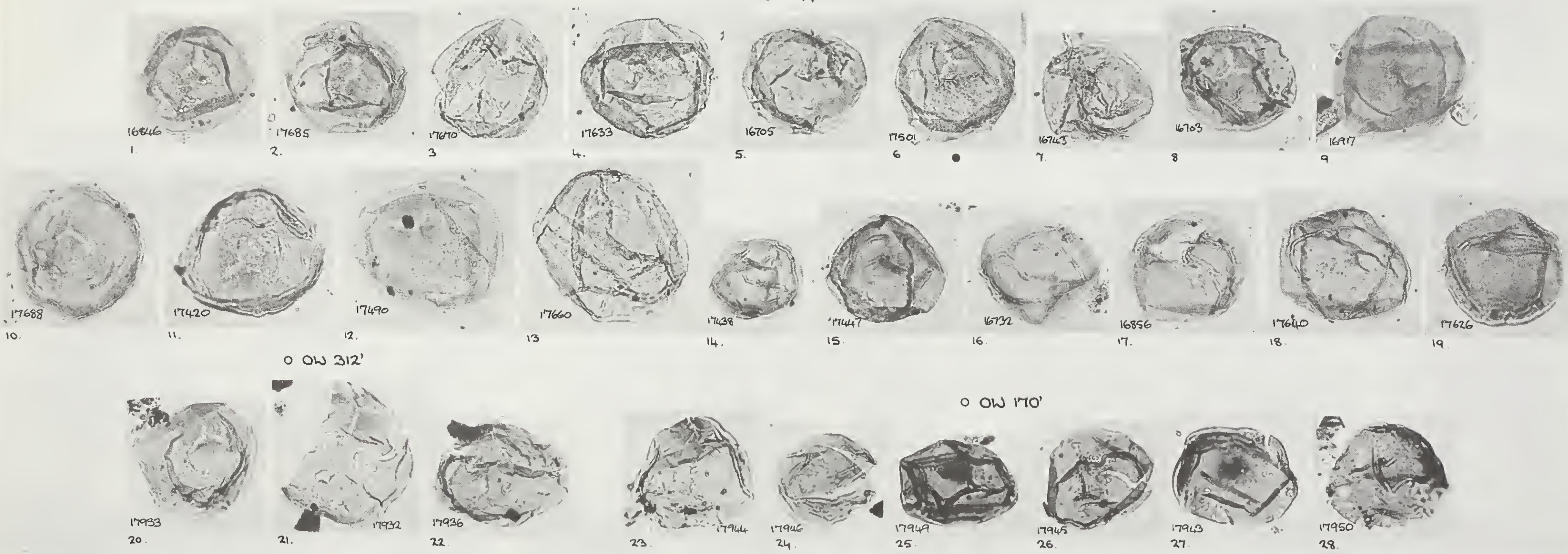


○ Kb.



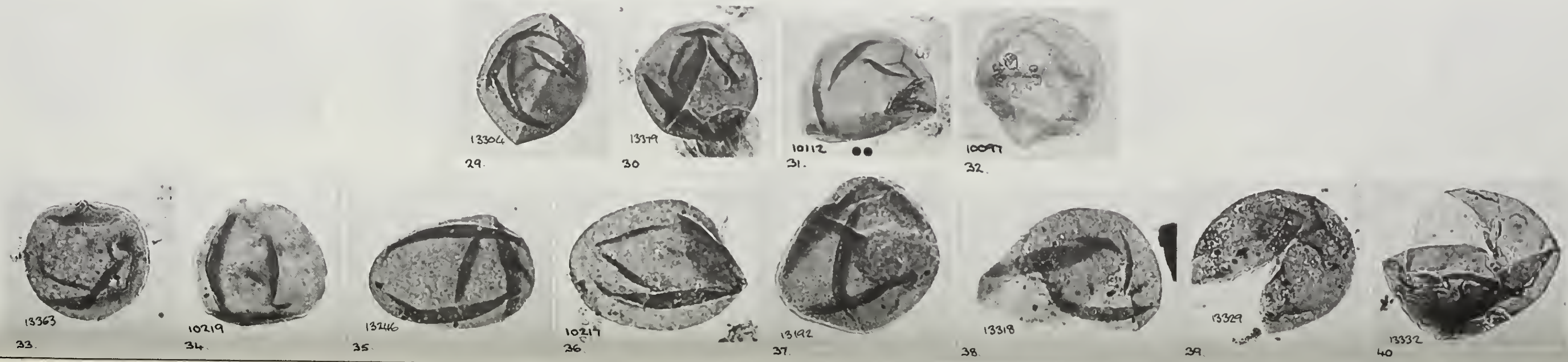
Calamospora aplata Bharad. + Sal. '64

● OW 94'



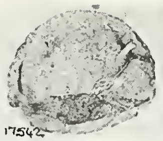
Calamospora sinesignis sp.nov.

● Kb



Inaperturosporites inapertus gen. et. sp. nov.

● OW 94'



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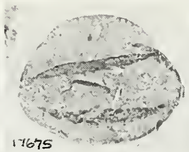

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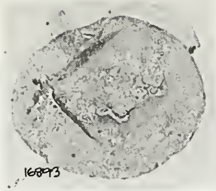

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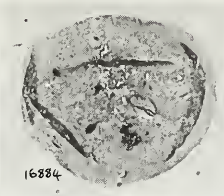

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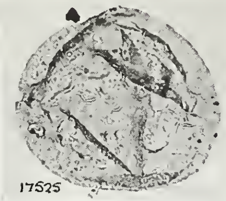

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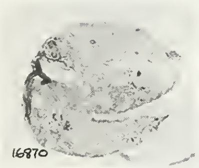

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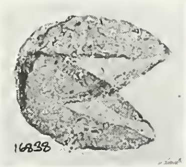

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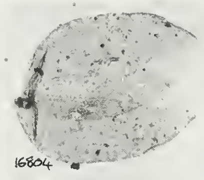

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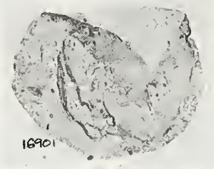

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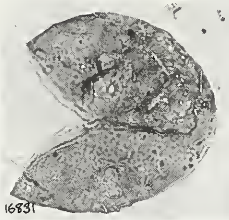

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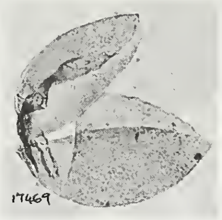

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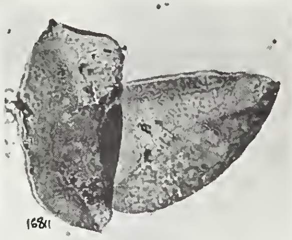

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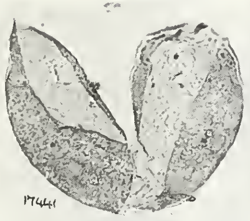

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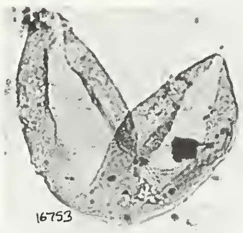

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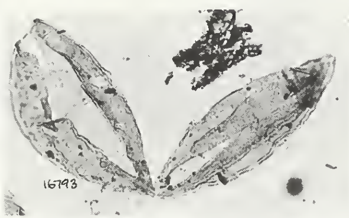

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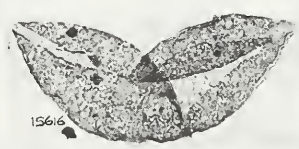

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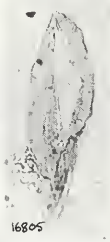

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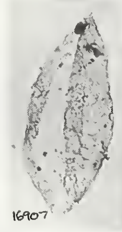

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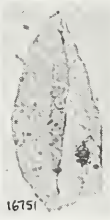
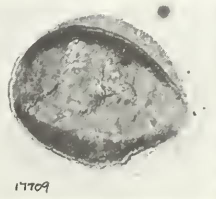


19.

Inaperturosporites vesiculatus sp. nov.

● OW 94'



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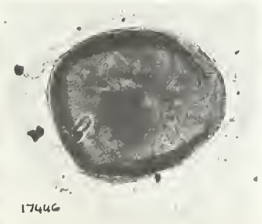

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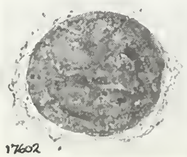

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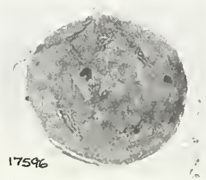

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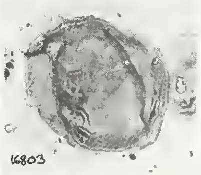

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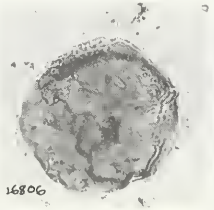

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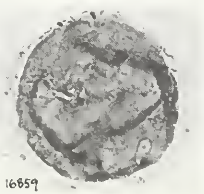

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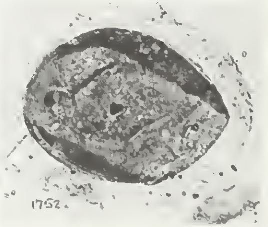
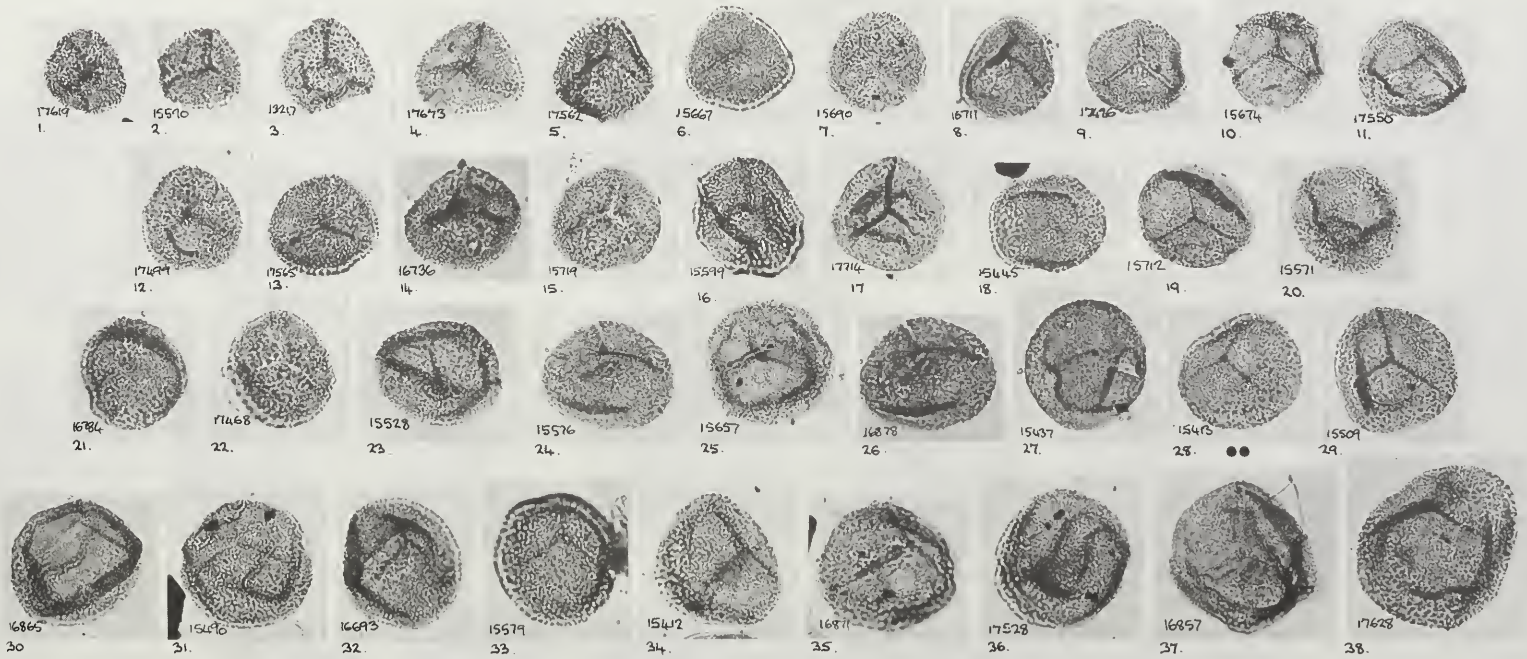


27.

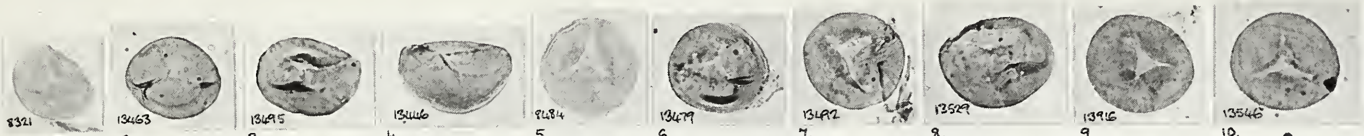
Partimtactosporites verrucosus gen. et. sp. nov.

● OW 94'

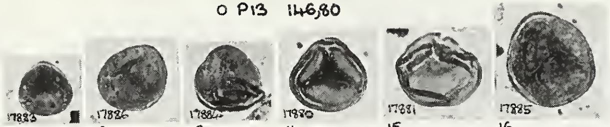


Apiculatisporis diversiformis (Balme & Henn.'56) comb. nov.

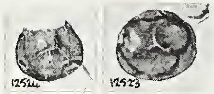
● SAP 6 1133'



○ P13 146,80

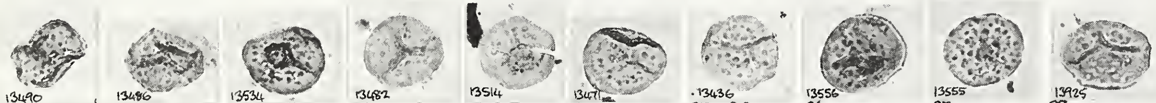


○ HKr.



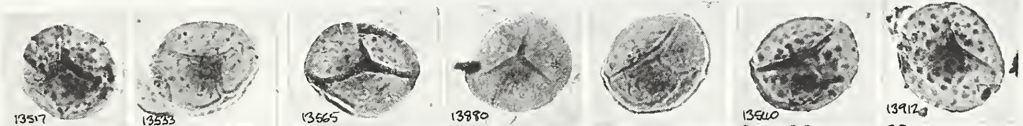
Apiculatisporis minor sp. nov.

● SAP 6 1133'



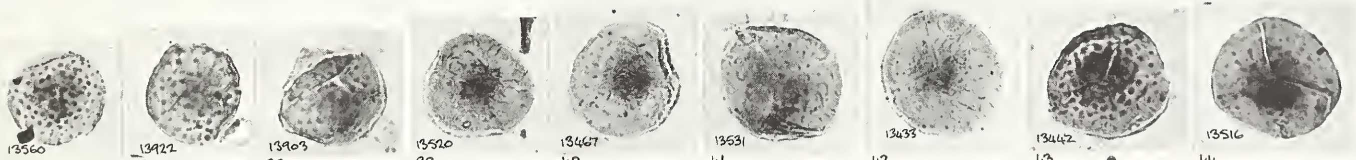
Apiculatisporis major sp. nov.

● SAP 6 1133'



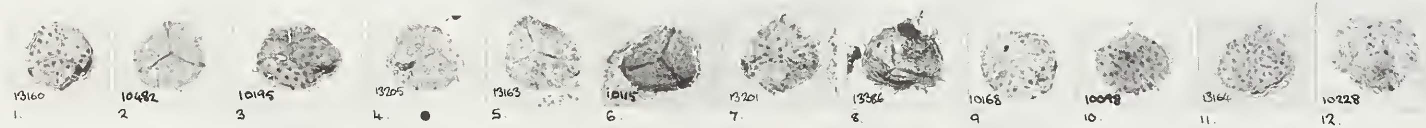
Apiculatisporis levis (Balme & Henn.'56) Bose & Mahesh '68

● SAP 6 1133'

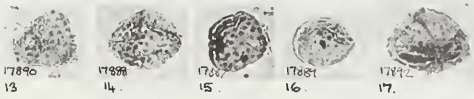


Apiculatisporis bulliensis (Henn.'58) comb. nov.

● Kb

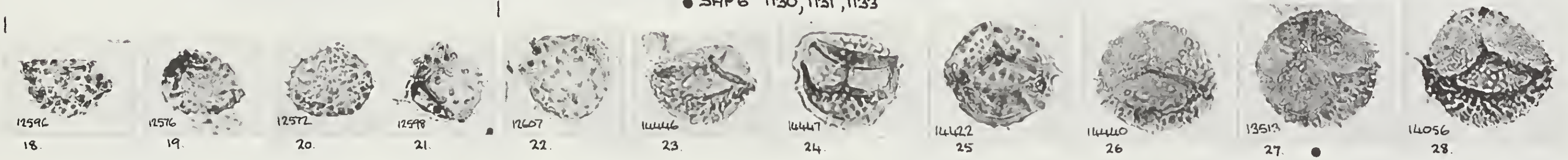


○ P13 146,80



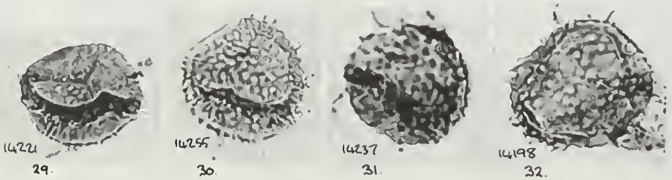
Apiculatisporis bulliensis (Henn.'58) comb. nov. / A. cornutus (Balme + Henn.'56) Hoeg + Bose '60
pl. 78 (18-21) pl. 78 (22-28)

○ ● SAP6 1130', 1131', 1133'

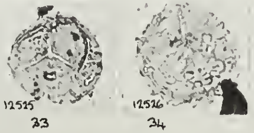


Apiculatisporis cornutus (Balme + Henn.'56) Hoeg + Bose '60

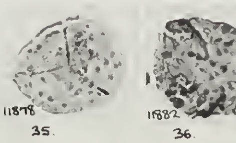
○ SAP6 1152'3", 1152'9"



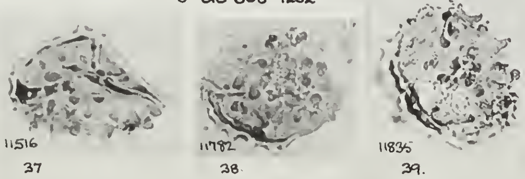
○ HKr.



○ UC 608 1590'

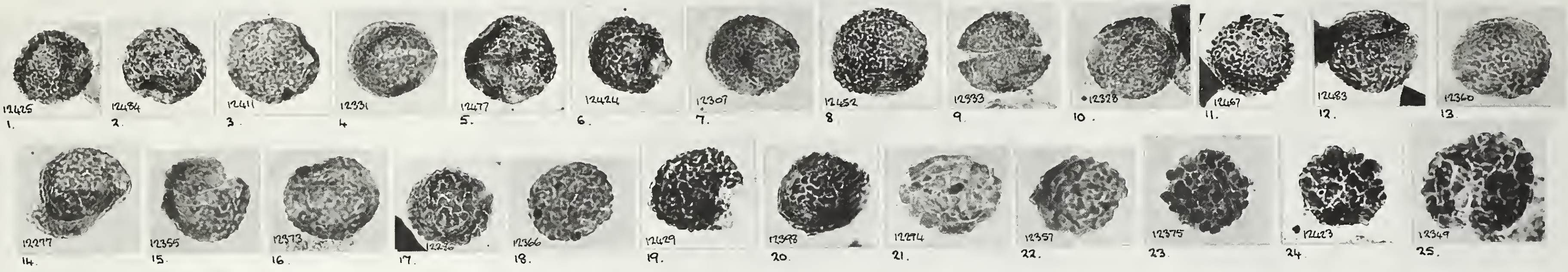


○ UC 608 1262'

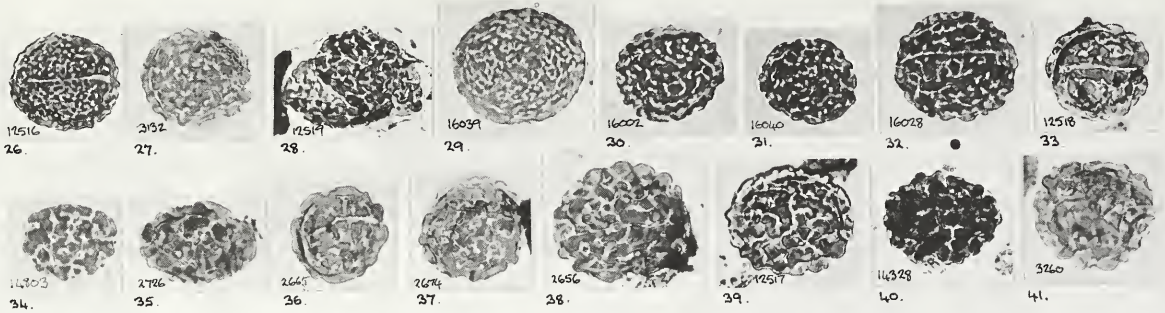


Polypodiisporites detritus (Leschik '59) comb. nov.

○ UC 678 30,6 , 31,6

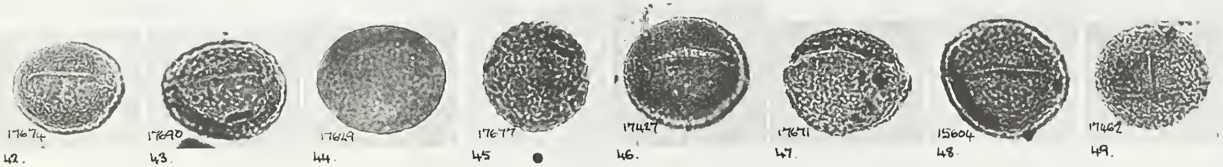


● HKr



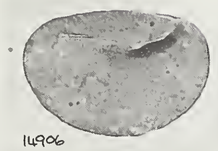
Polypodiisporites mutabilis Balme '70

● OW 94'



Laevigatosporites vulgaris Ibrahim'33 / Laevigatosporites striatus (Sal.'65) comb. nov.
pl. 80 (1-6) pl. 81 (1-32)

● HKr.
●



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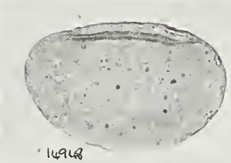

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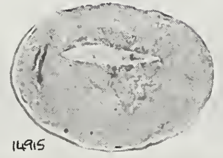

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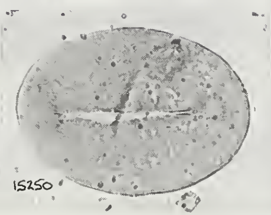

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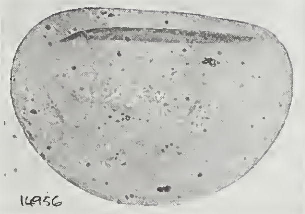

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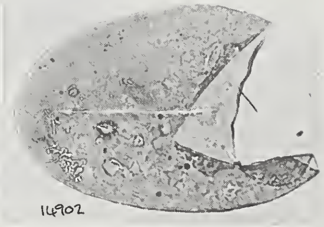
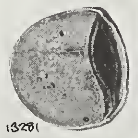


6.

Laevigatosporites vulgaris Ibrahim'33

o Kb.



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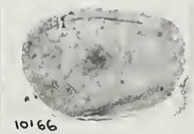

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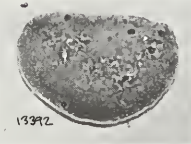

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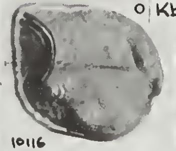

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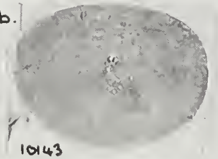

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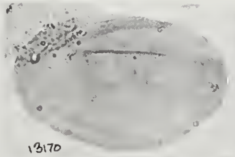

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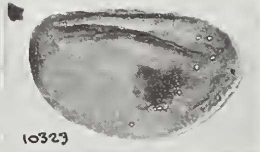

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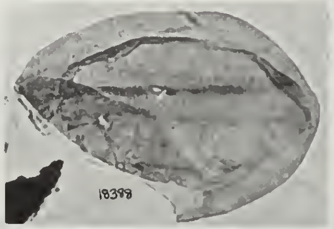
Laevigatosporites striatus (Sal.'65) comb. nov.

o OW 1145'



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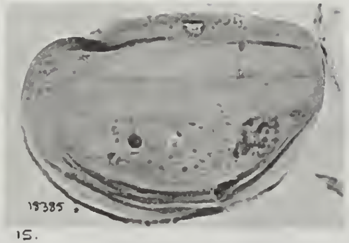

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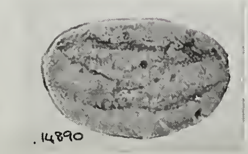
Laevigatosporites varistriatus sp. nov.

● HKr.



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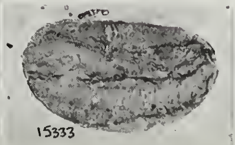

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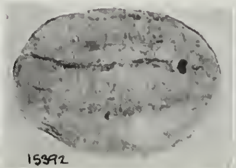

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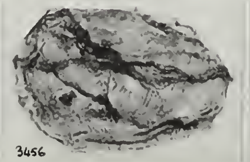

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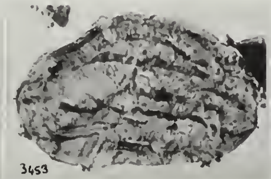

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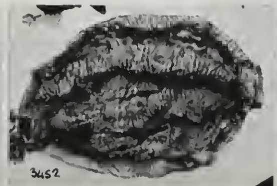

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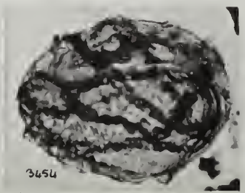

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Laevigatosporites vulgaris Ibrahim'33/ Laevigatosporites striatus (Sal.'65) comb. nov.
pl. 80 (1-6) pl. 81 (1-32)

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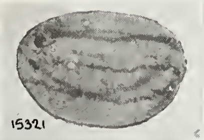
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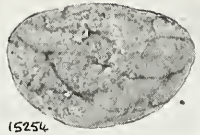
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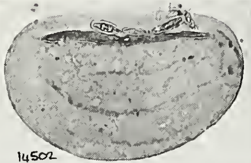
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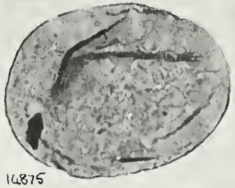
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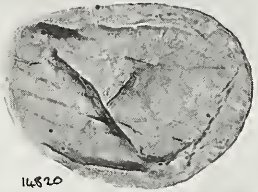
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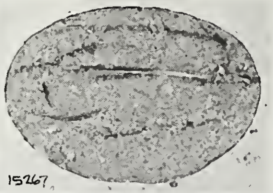
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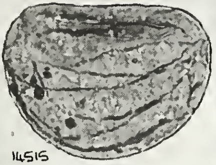
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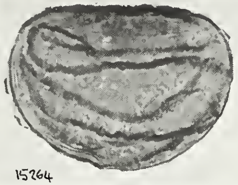
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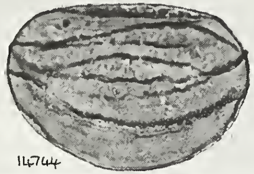
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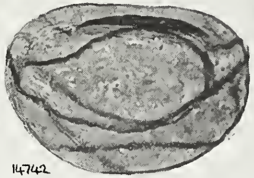
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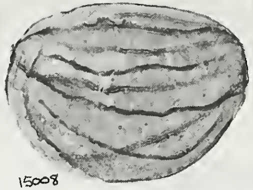
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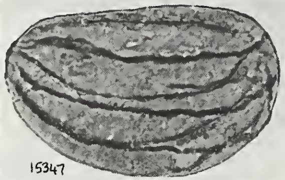
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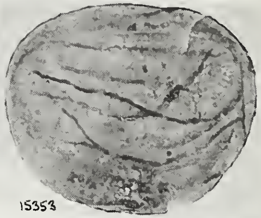
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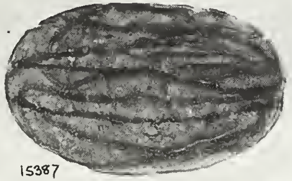
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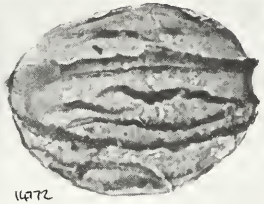
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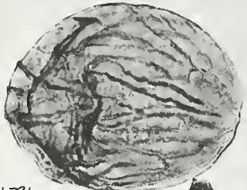
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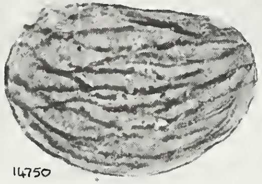
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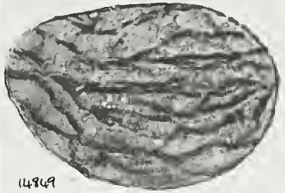
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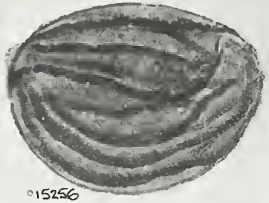
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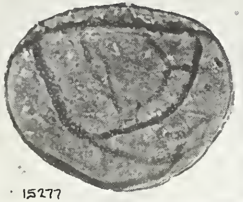
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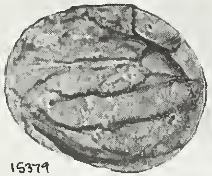
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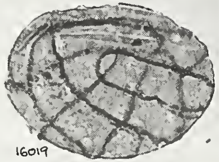
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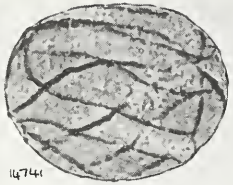
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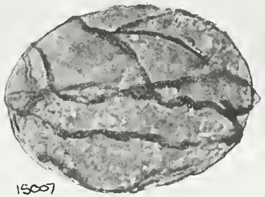
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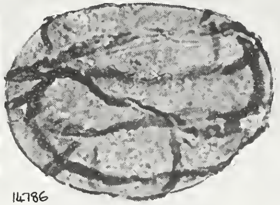
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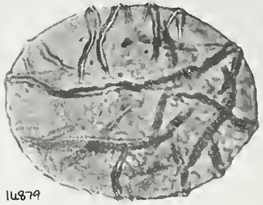
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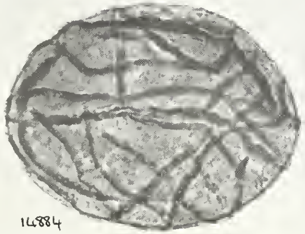
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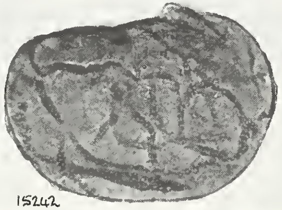
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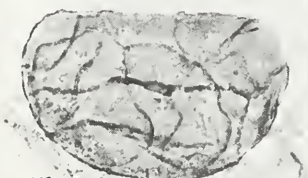
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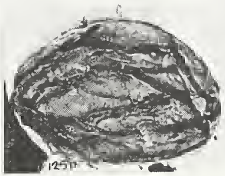
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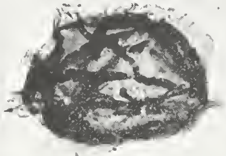
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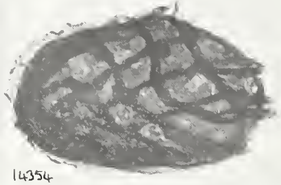
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Vestigisporites ventrisaccatus sp.nov.

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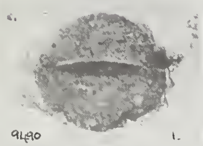
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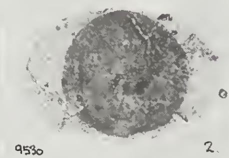
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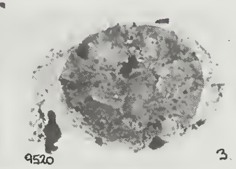
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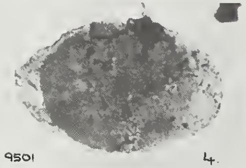
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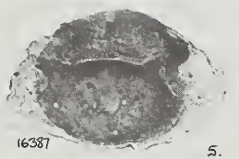
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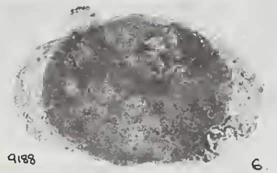
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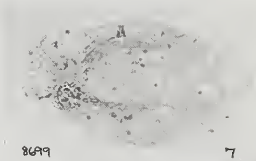
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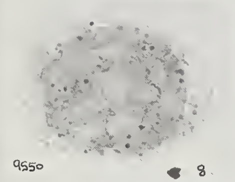
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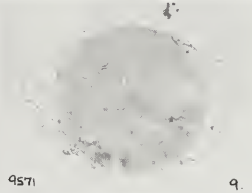
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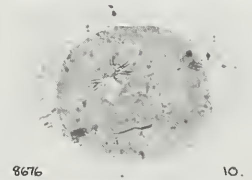
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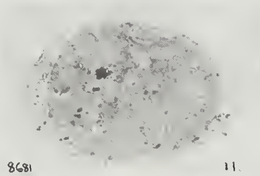
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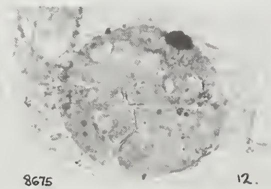
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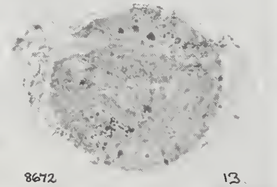
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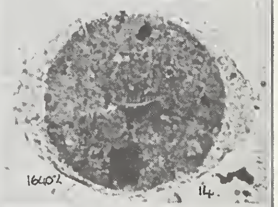
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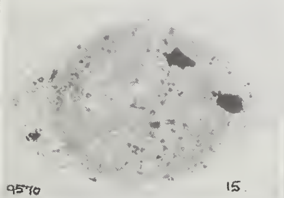
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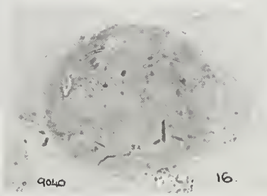
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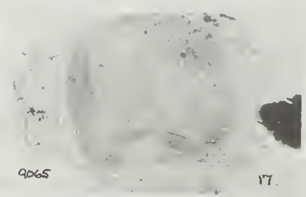
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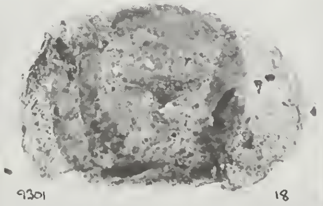
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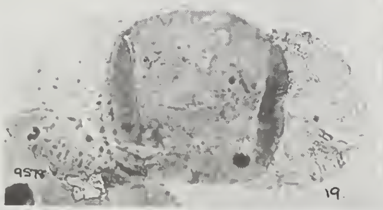
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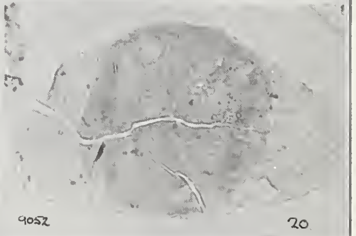
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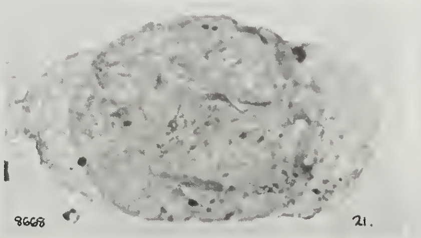
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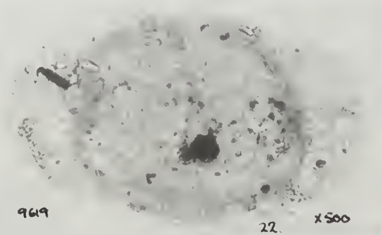
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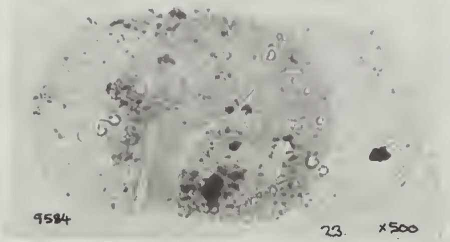
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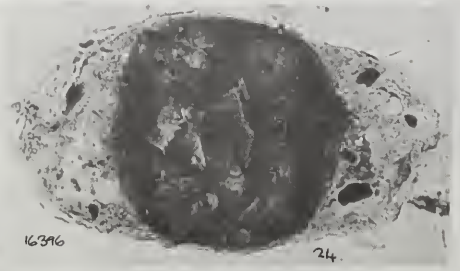
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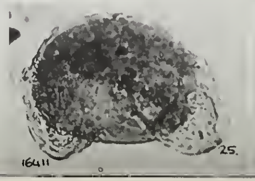
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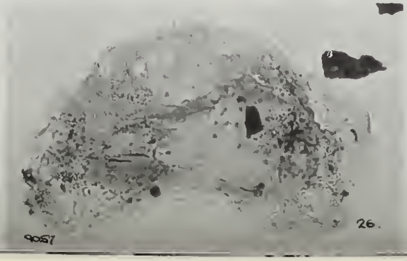
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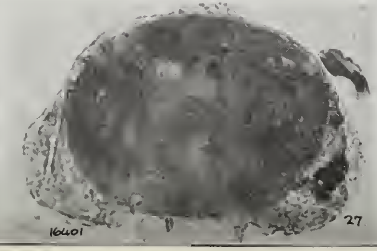
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Vestigisporites ventrisaccatus sp. nov.

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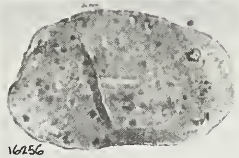

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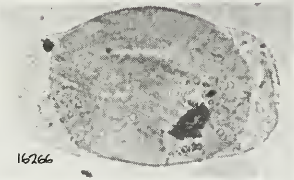

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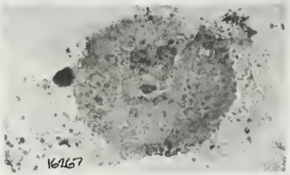

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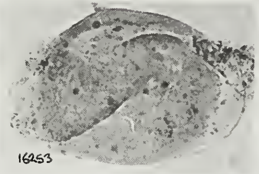

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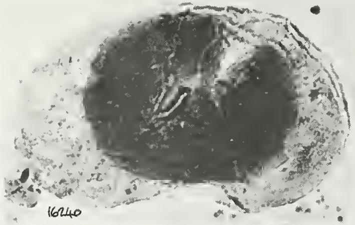

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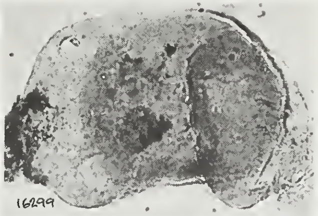

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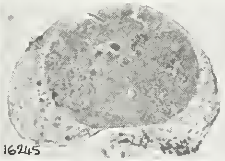

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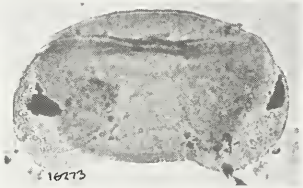

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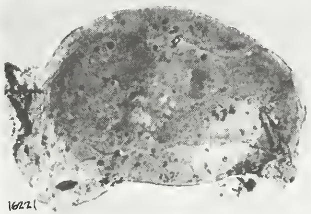

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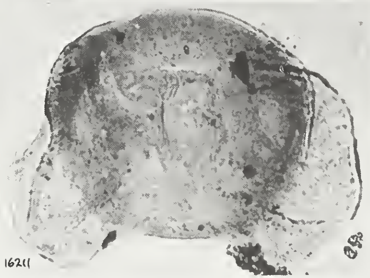

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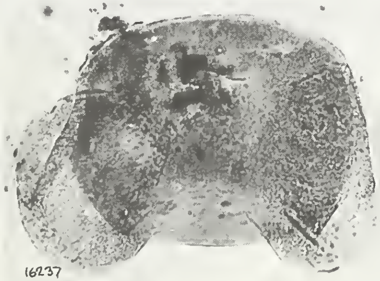

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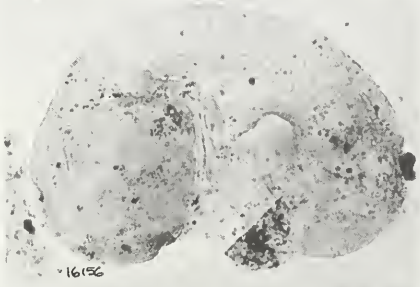

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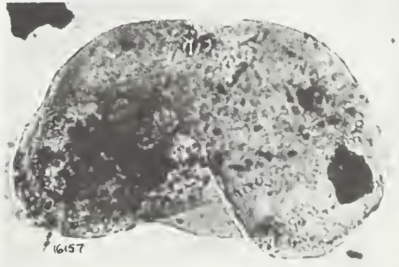

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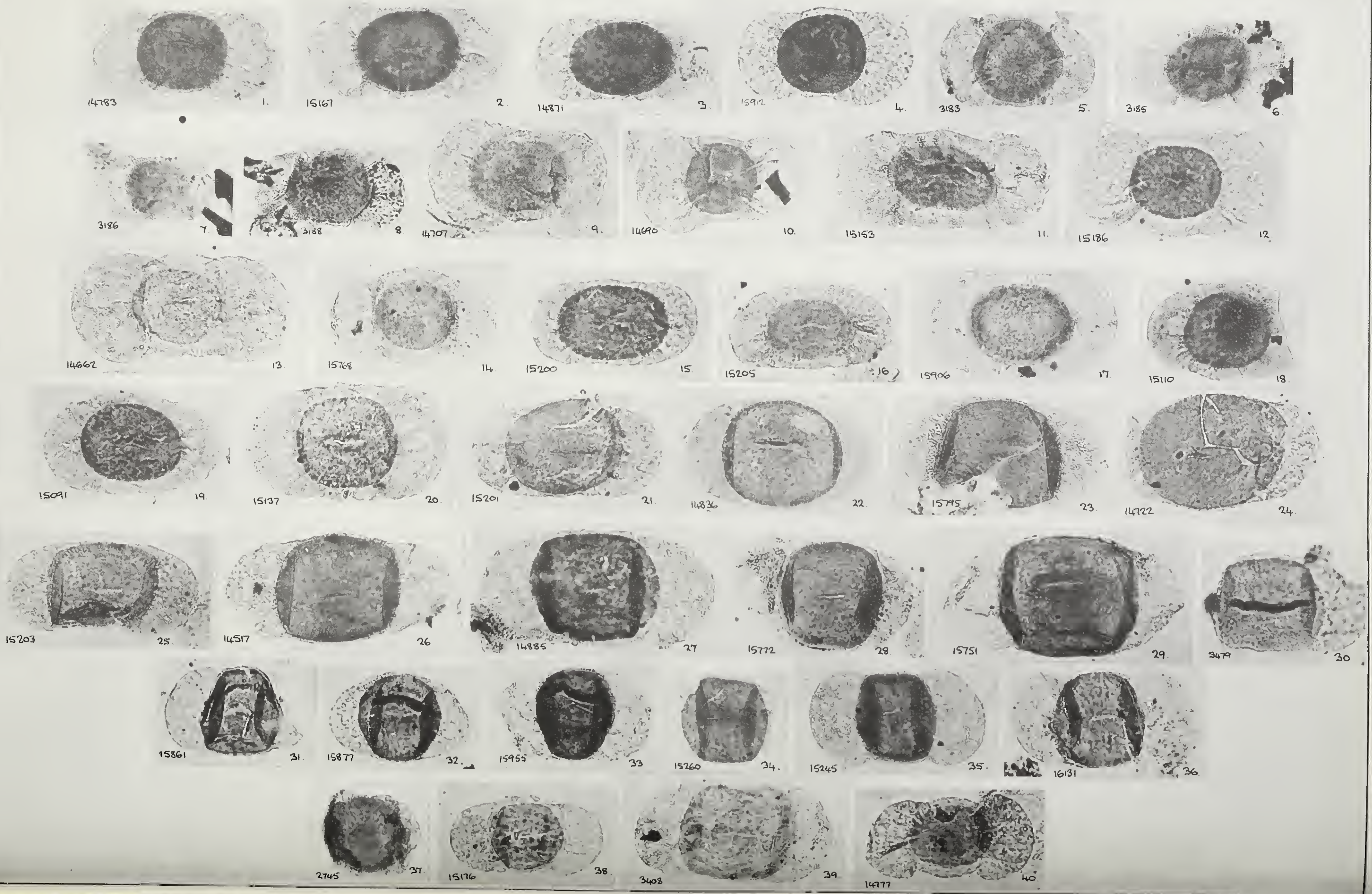
Vestigisporites rudis Balme & Henn. '55

● HKr.



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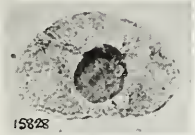

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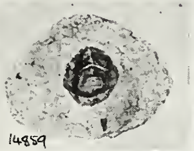

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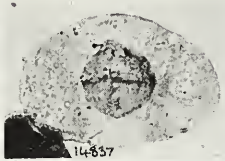

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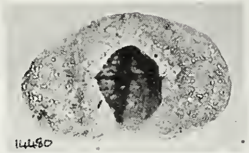

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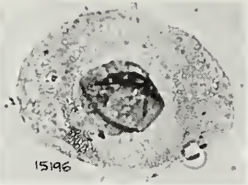

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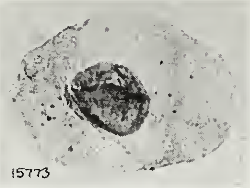

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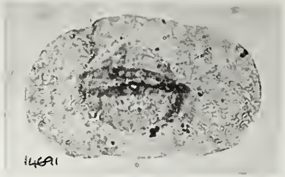

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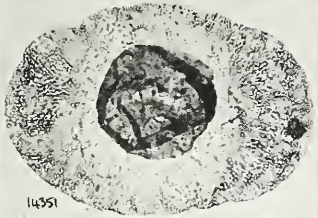

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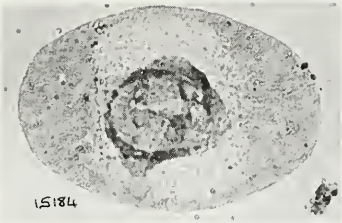

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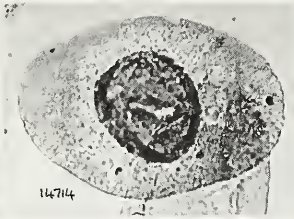

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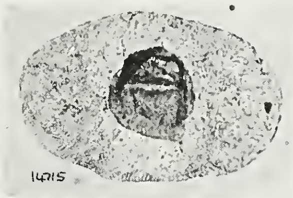

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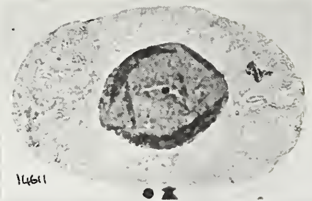

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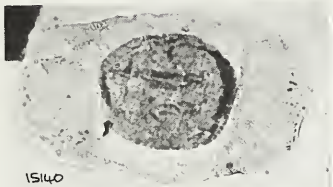

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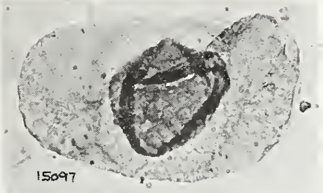

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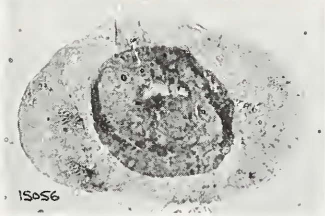

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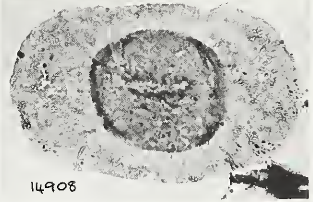

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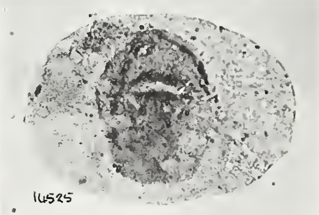

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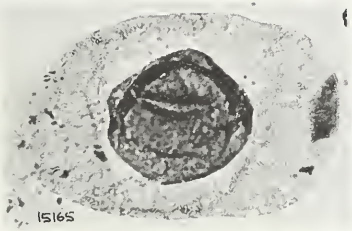

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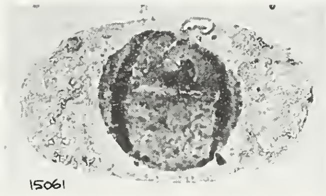

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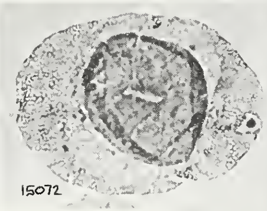

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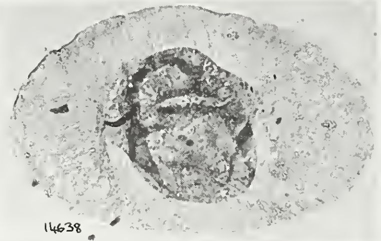

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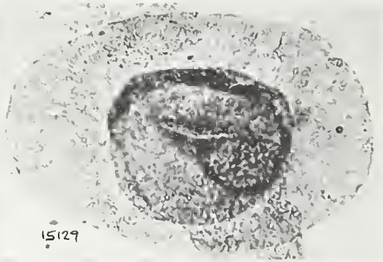

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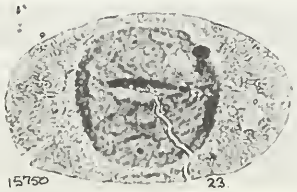

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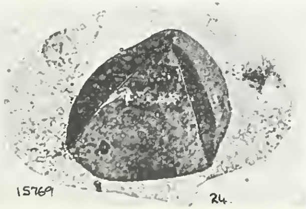

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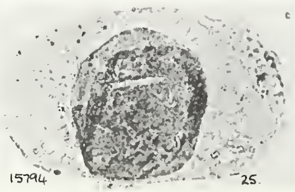

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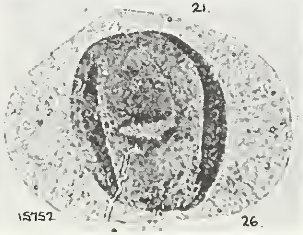

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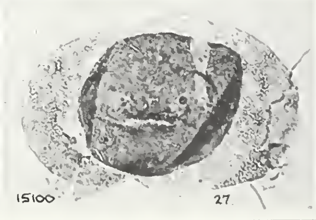

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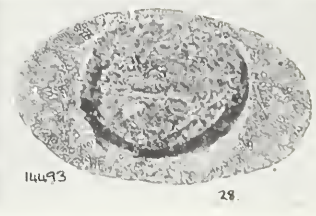

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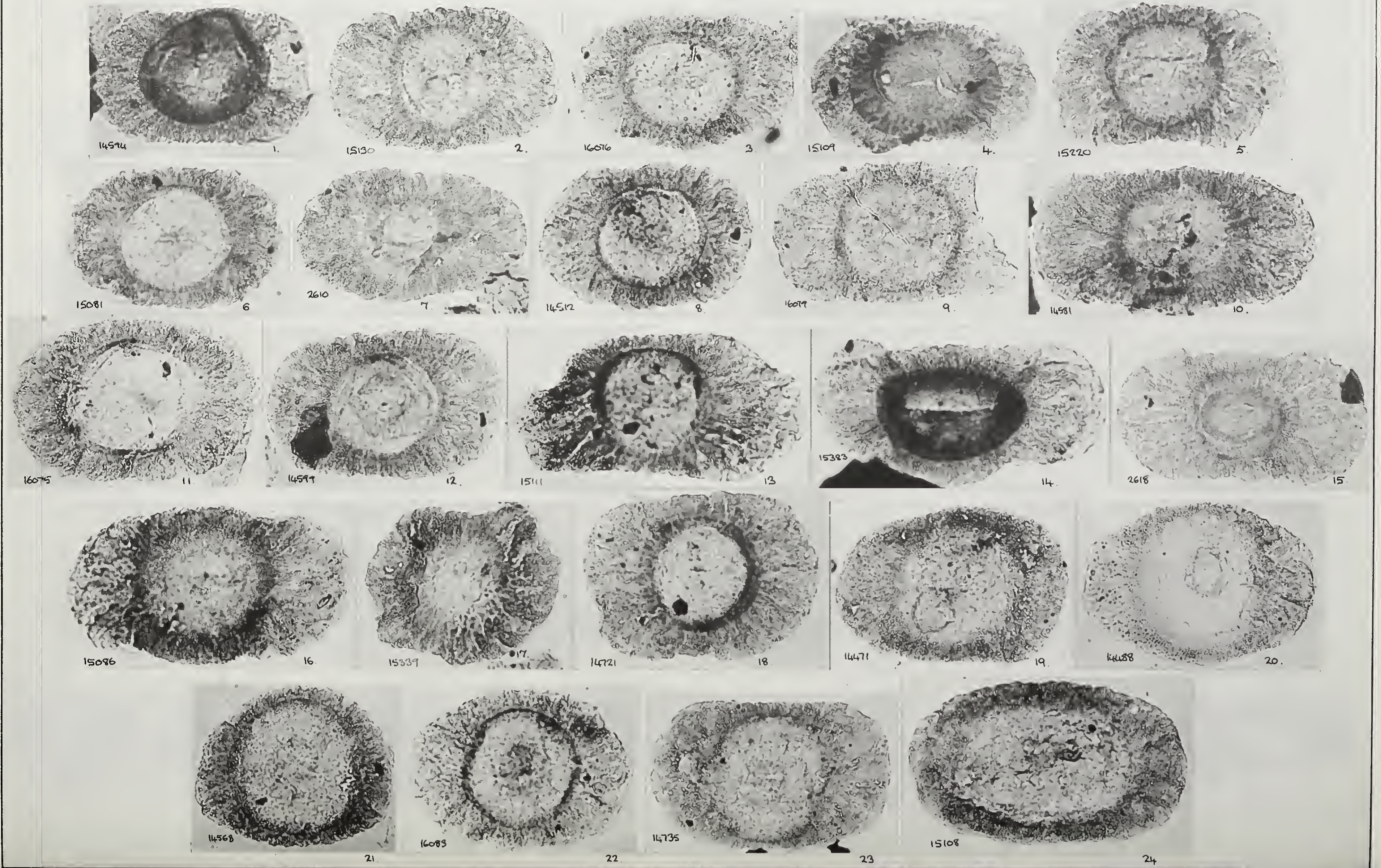
Vestigisporites balmei Hart'60

● HKr.



Vestigisporites balmei Hart'60

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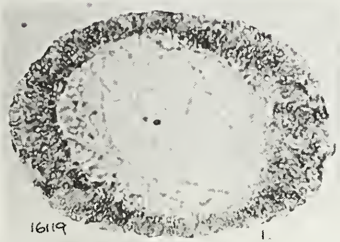

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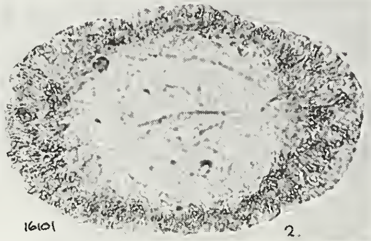

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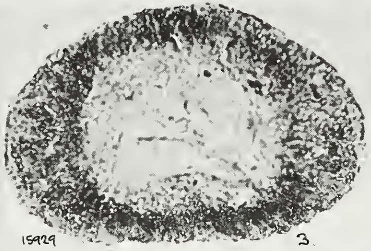

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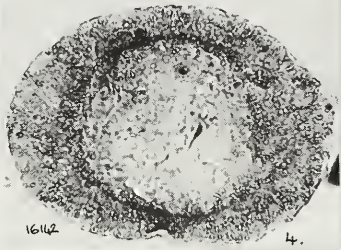

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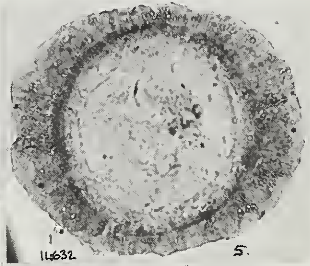

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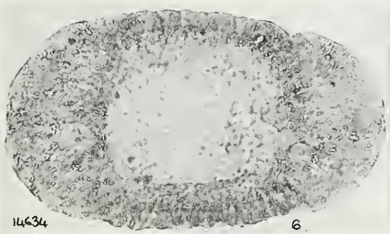

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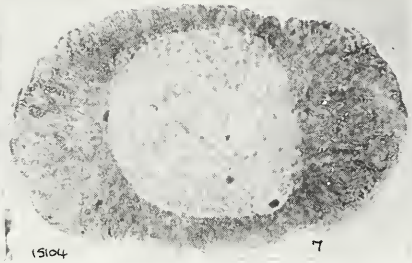

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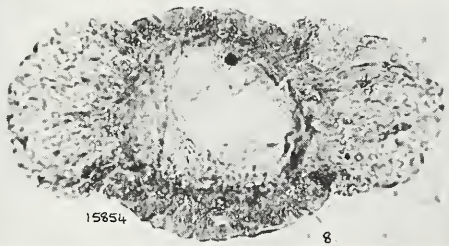

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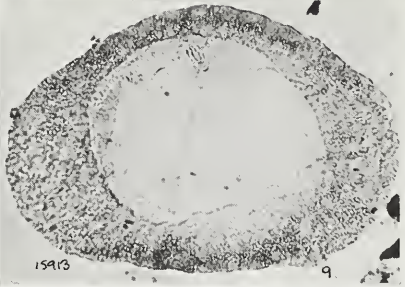

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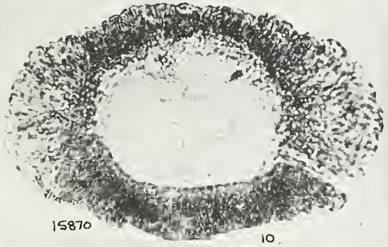

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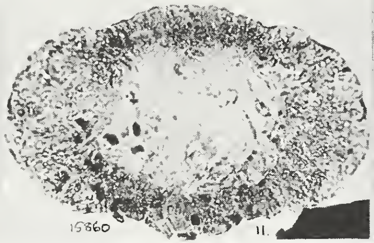

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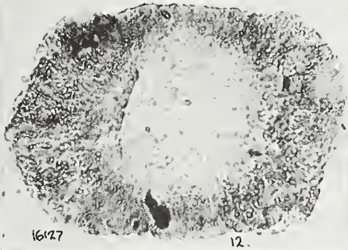

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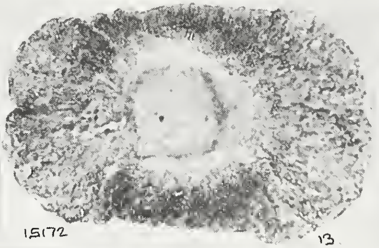

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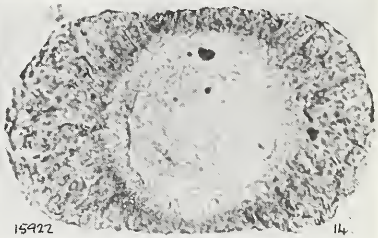

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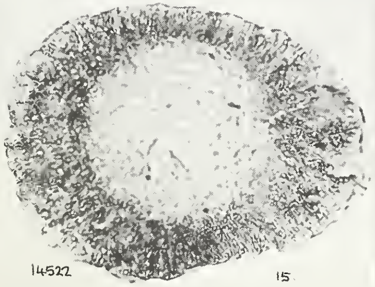

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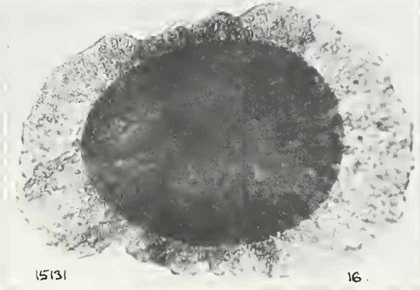

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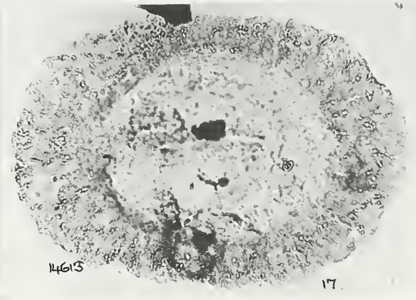

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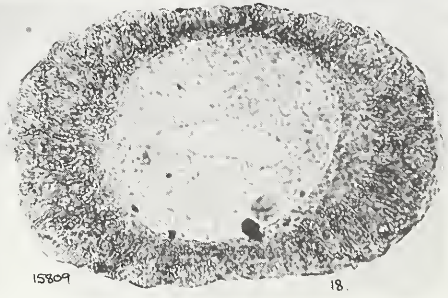

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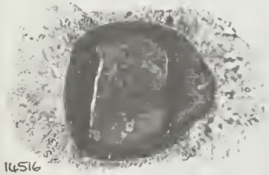
Vestigisporites balmei Hart'60

● HKr.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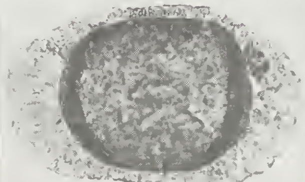
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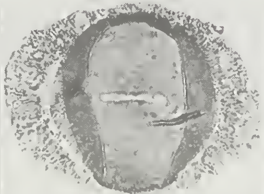
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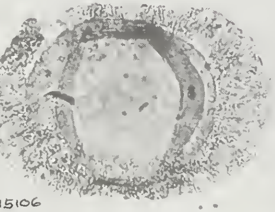
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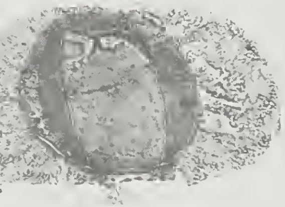
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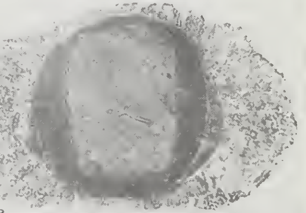
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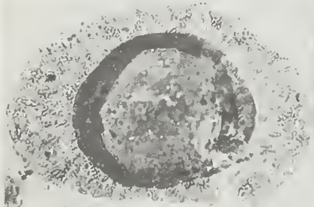
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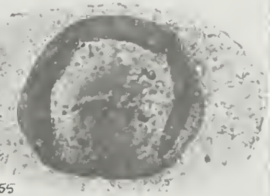
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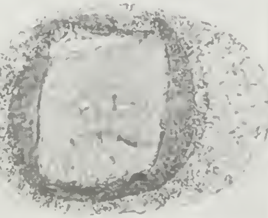
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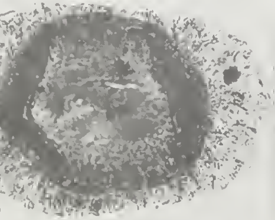
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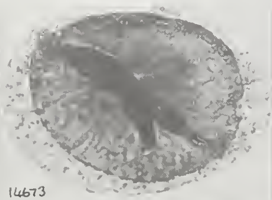
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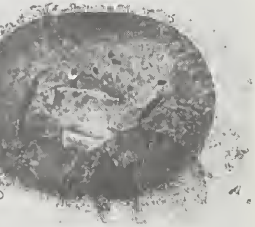
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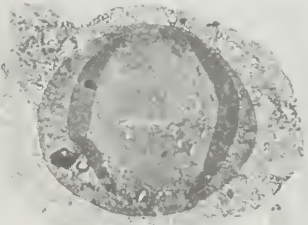
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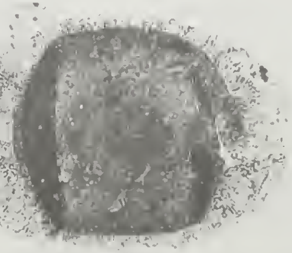
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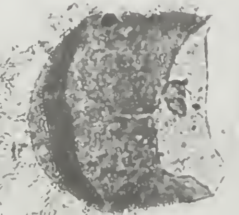
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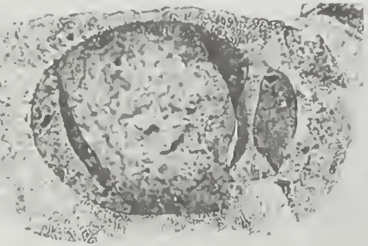
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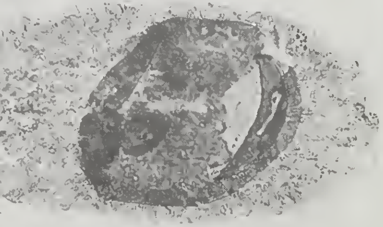
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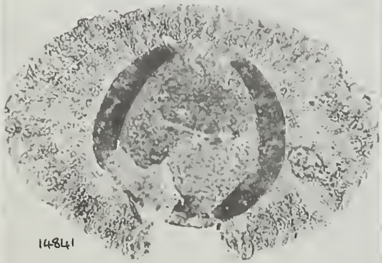
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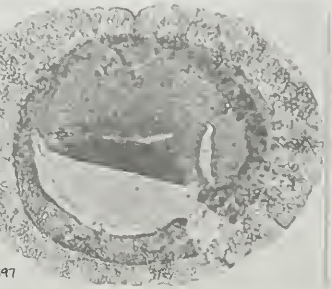
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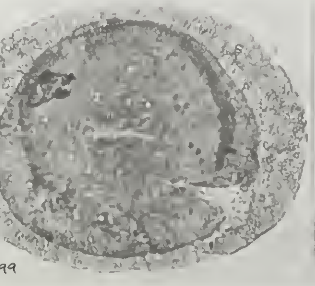
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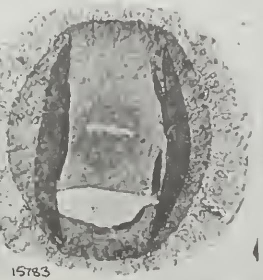
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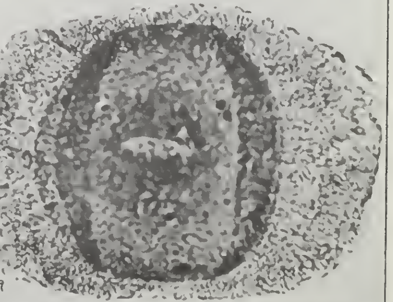
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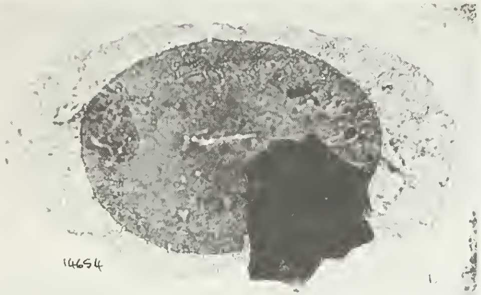
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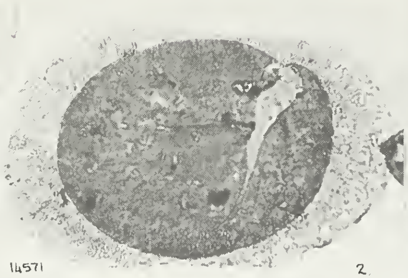
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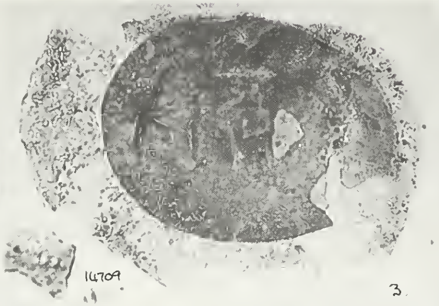
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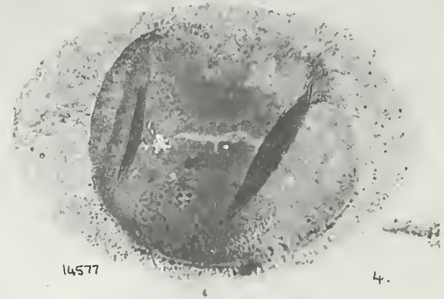
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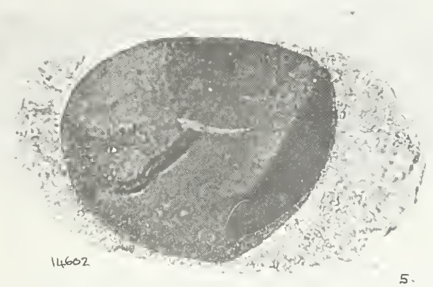
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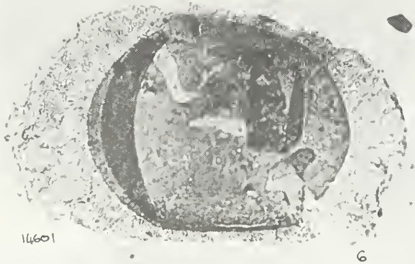
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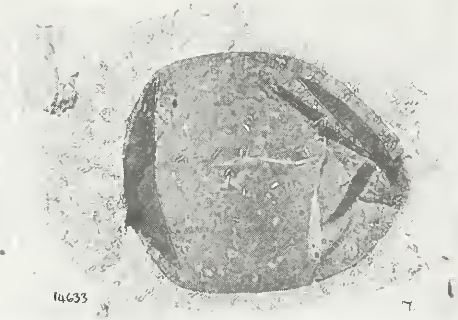
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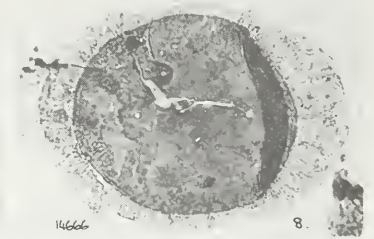
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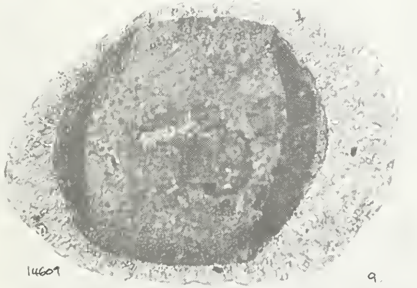
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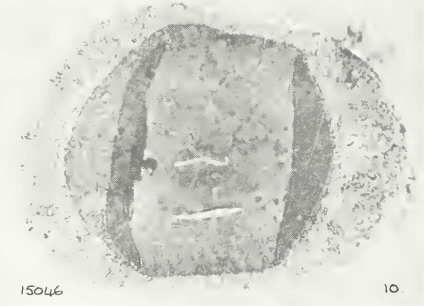
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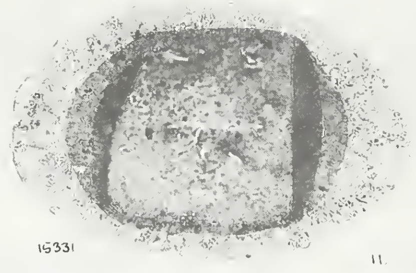
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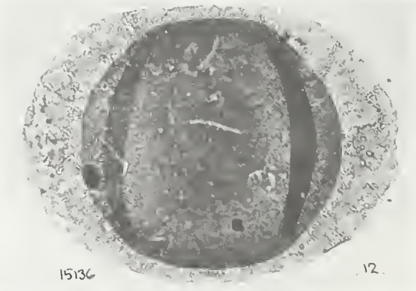
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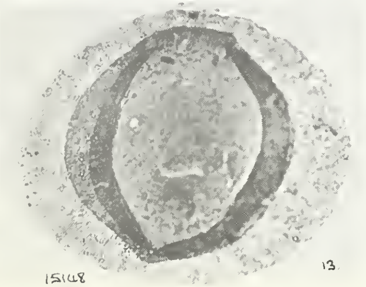
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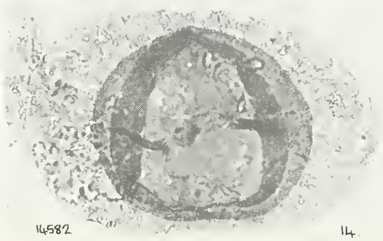
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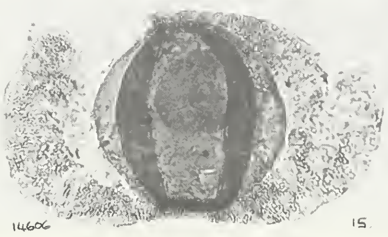
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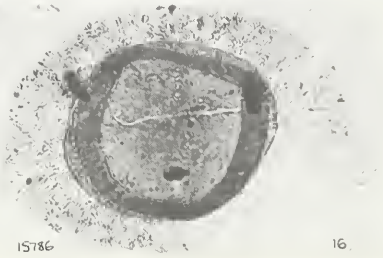
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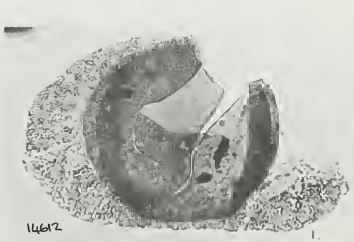
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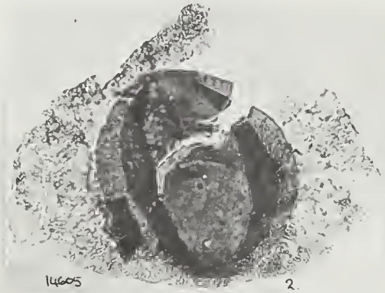
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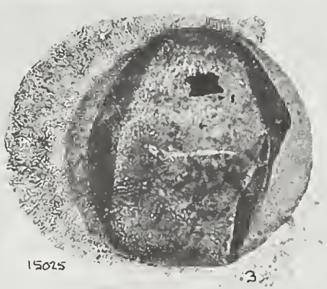
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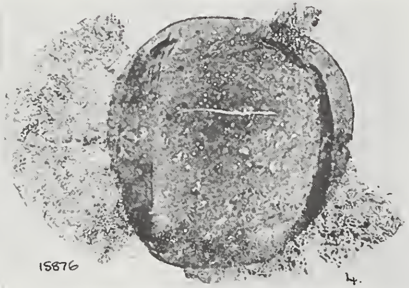
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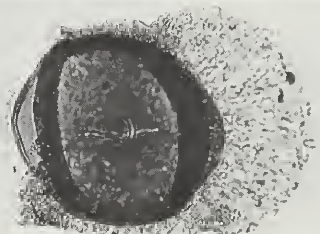
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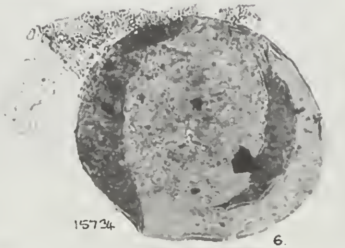
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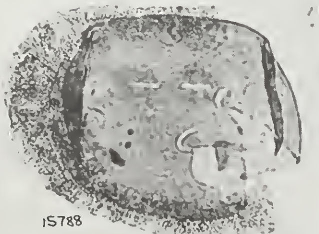
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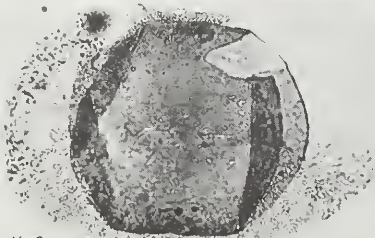
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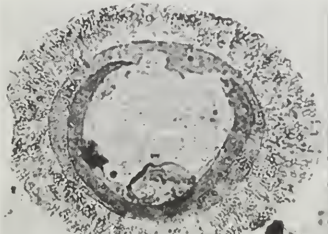
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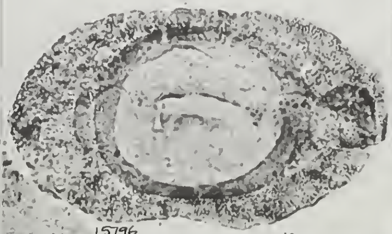
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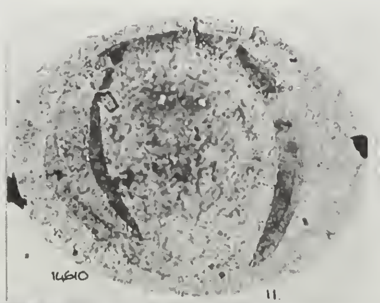
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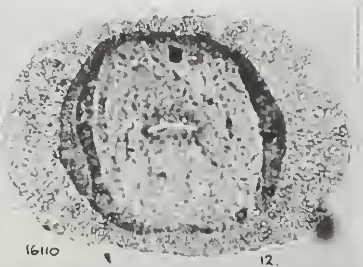
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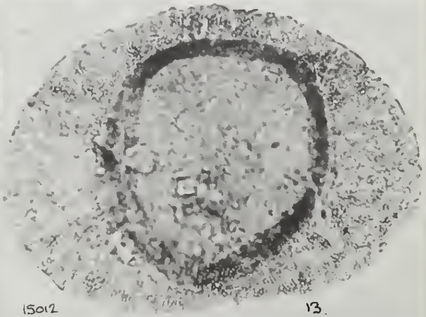
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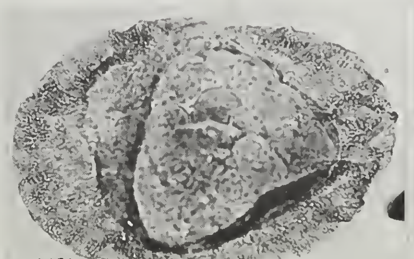
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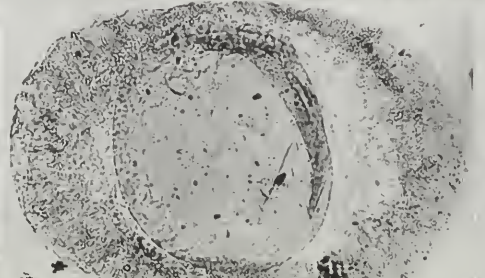
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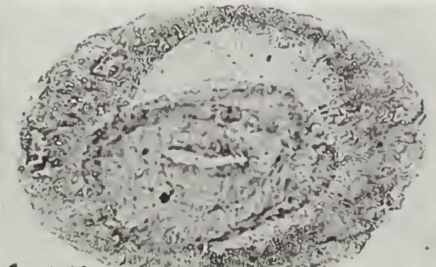
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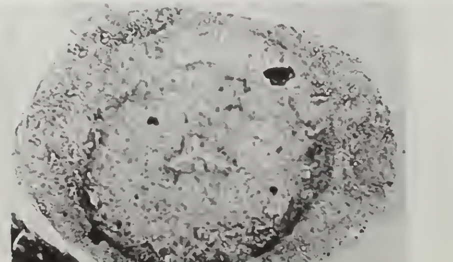
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Vestigisporites balmei Hart '60

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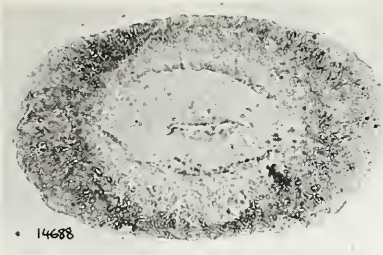

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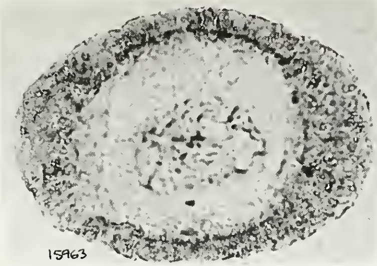

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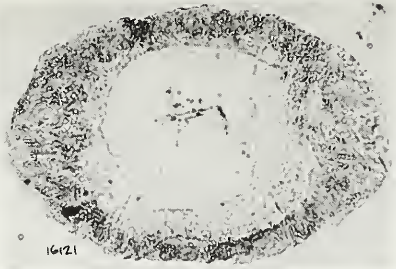

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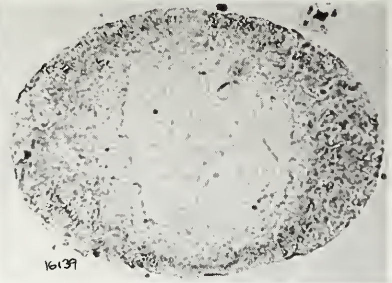

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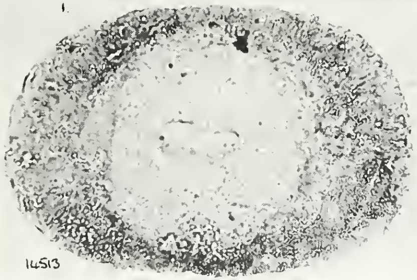

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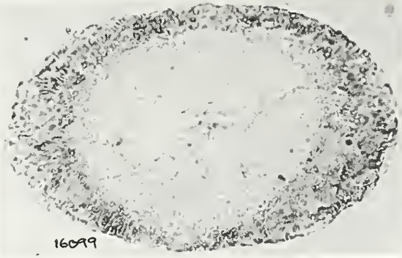

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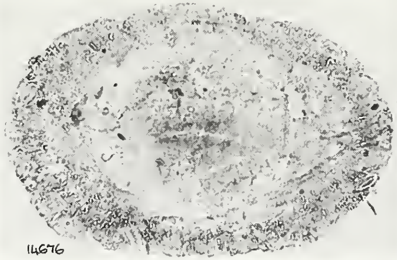

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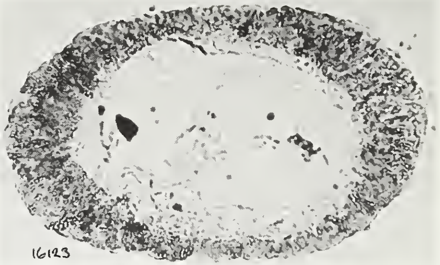

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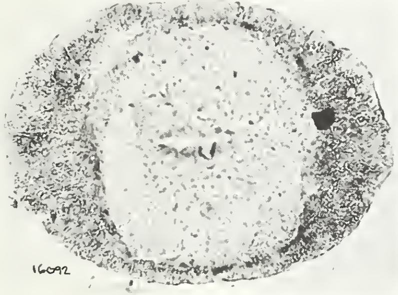

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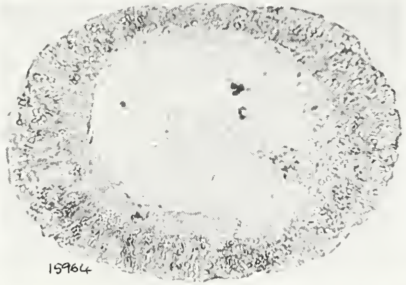

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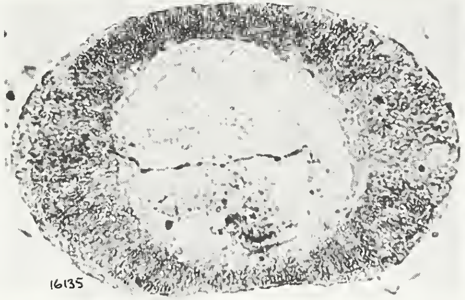

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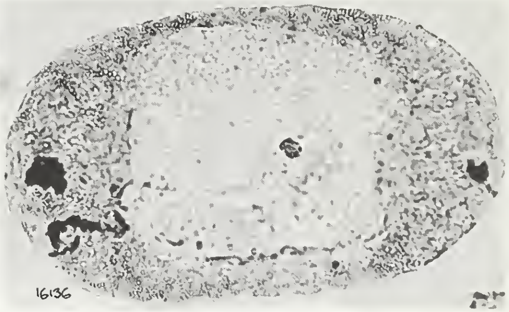

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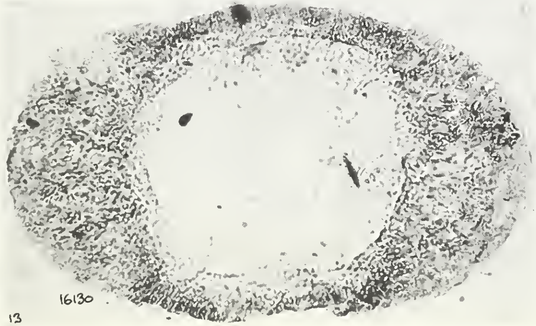

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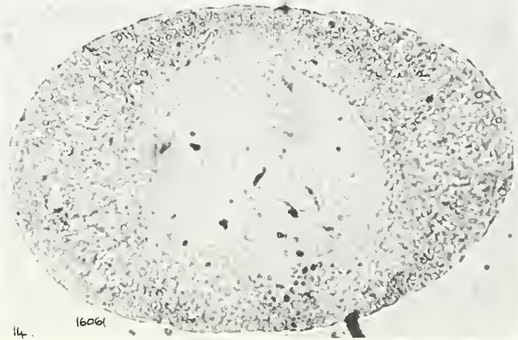

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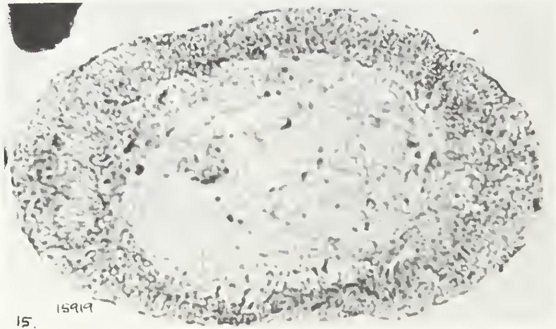

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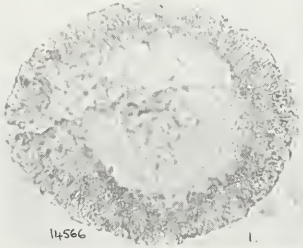
Vestigisporites balmei Hart '60

● HKr.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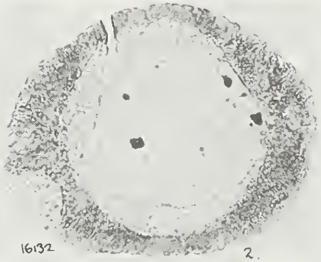
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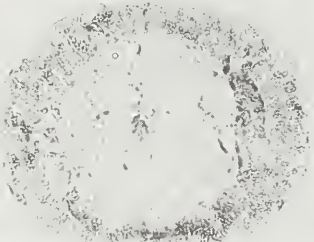
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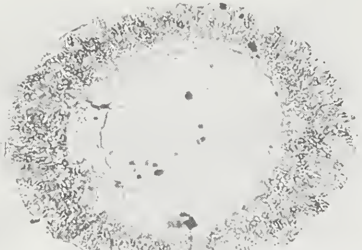
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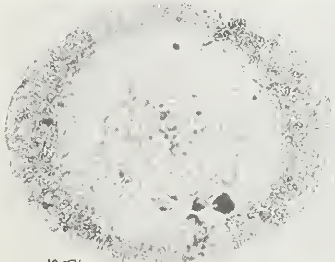
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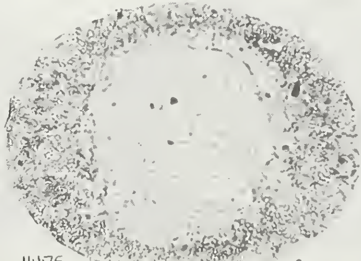
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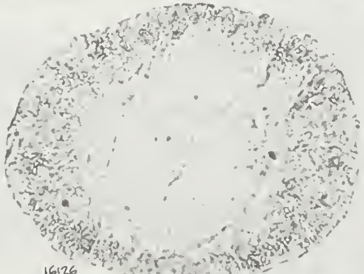
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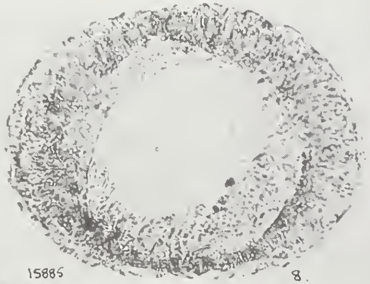
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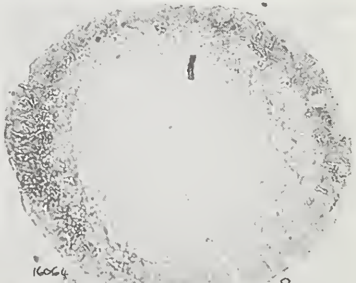
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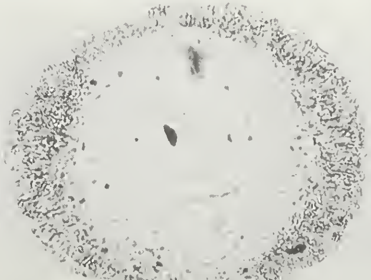
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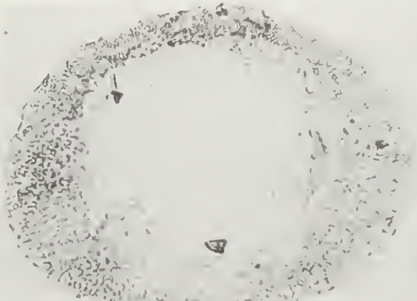
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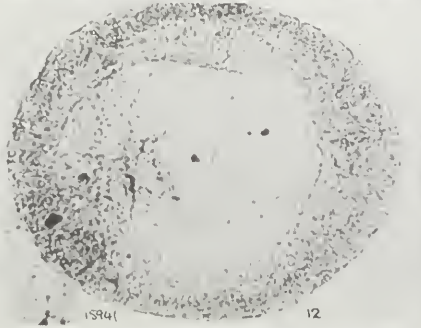
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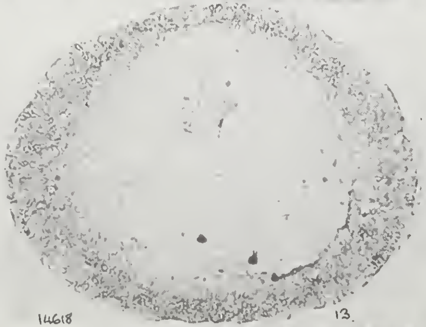
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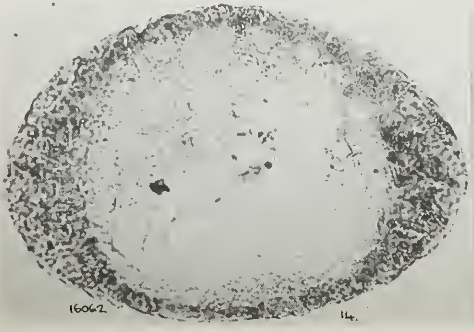
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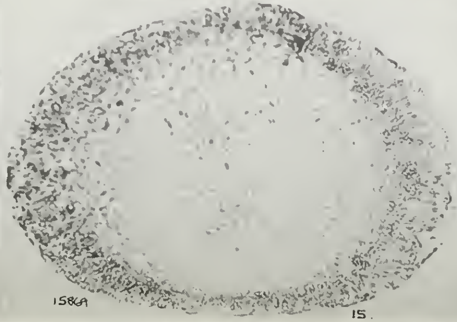
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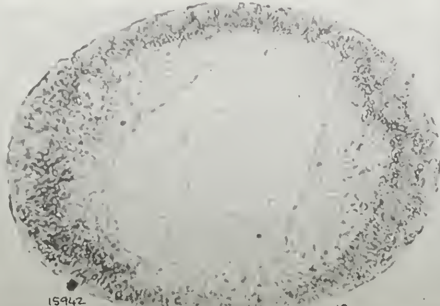
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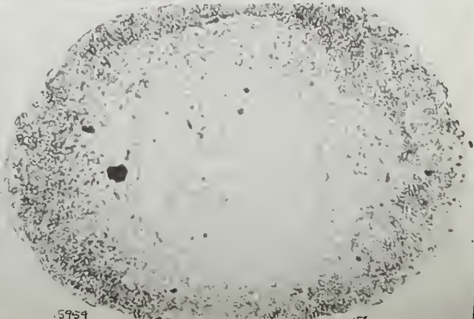
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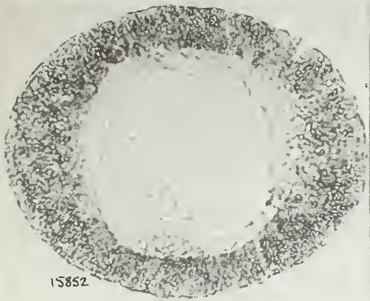
Vestigisporites balmei Hart'60

● HKr.



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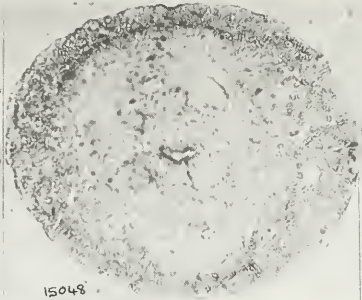

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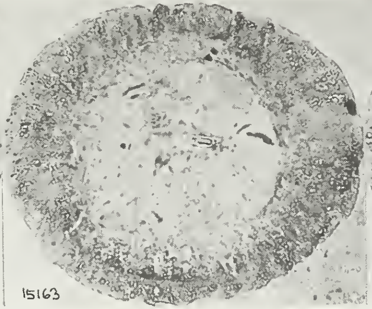

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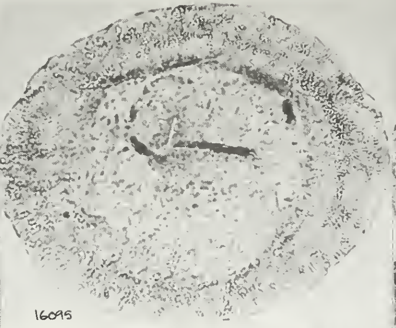

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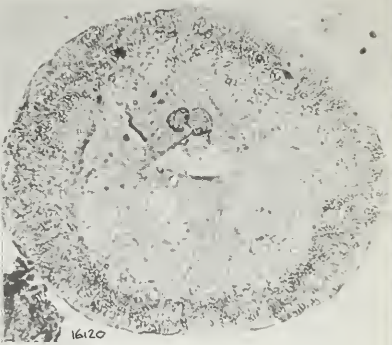

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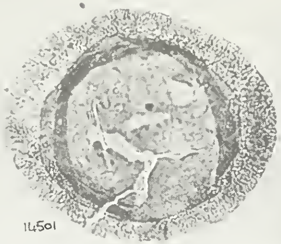

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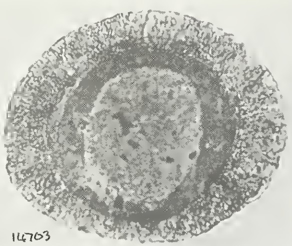

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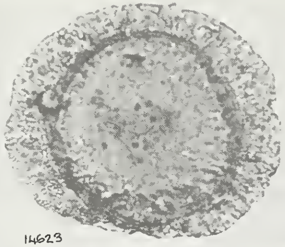

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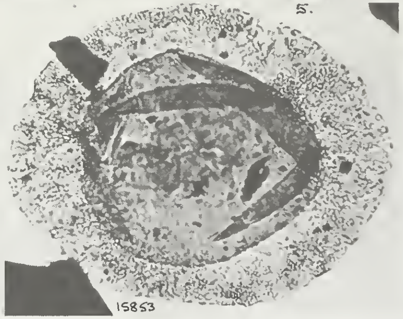

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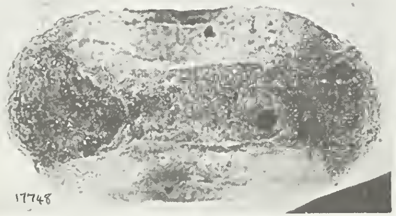

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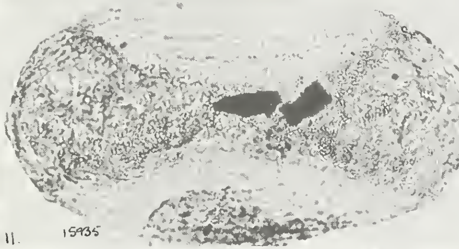

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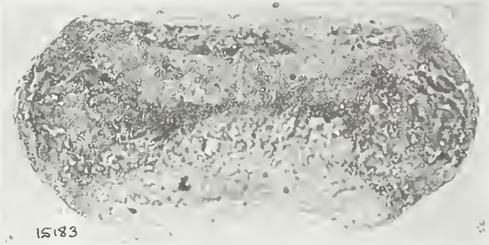

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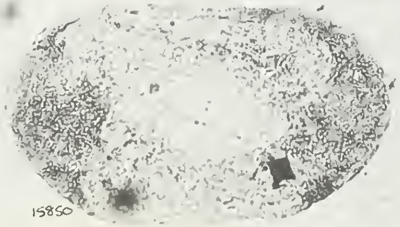

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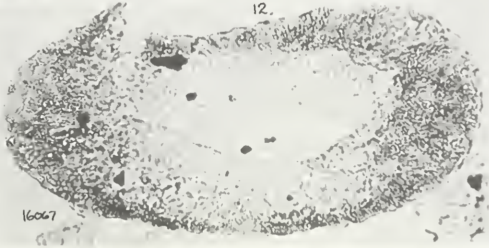
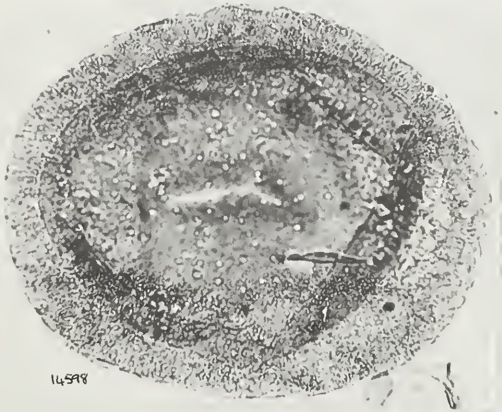


14.

Vestigisporites neglectus (Pot. & Lele '61) comb. nov.

● HKr.



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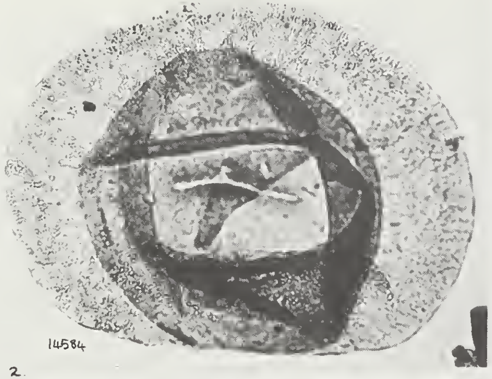

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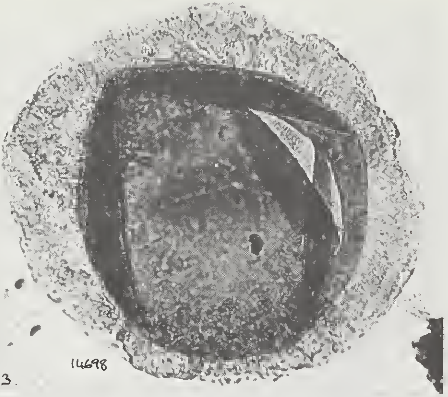

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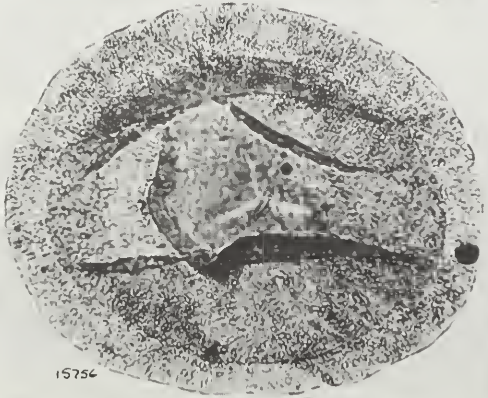

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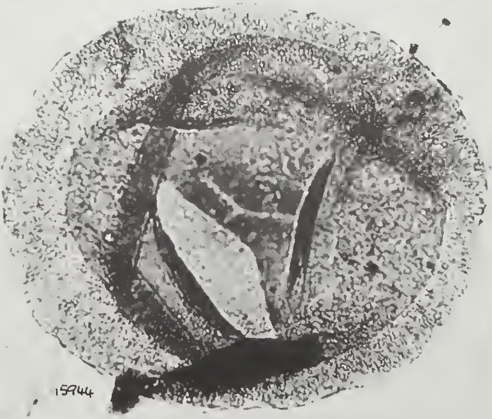

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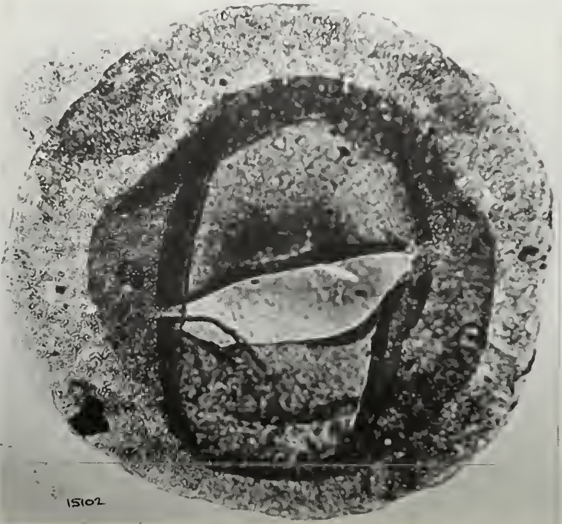

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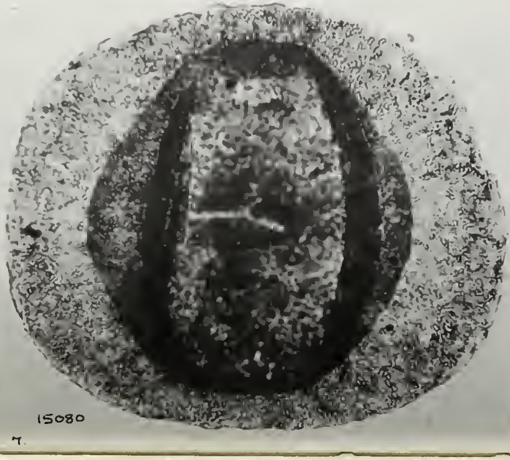

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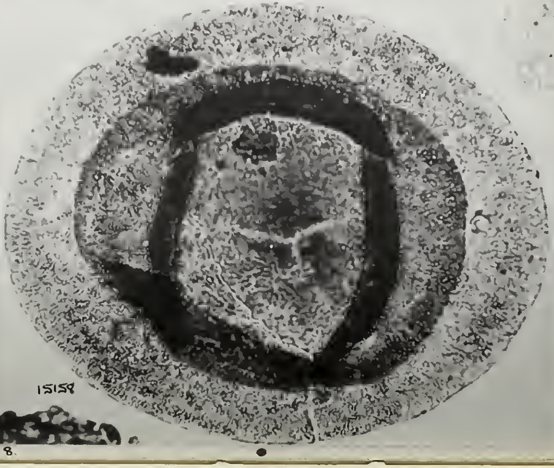
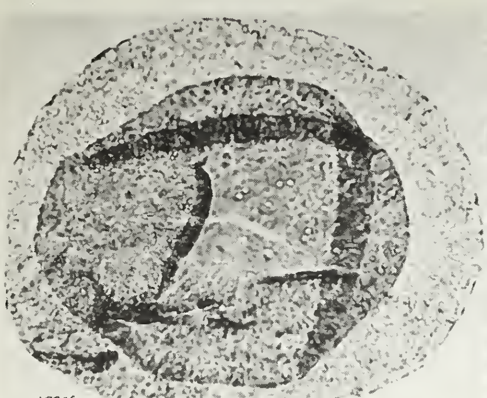


8.

Vestigisporites neglectus (Pot. & Lele '61) comb. nov.

● HKr.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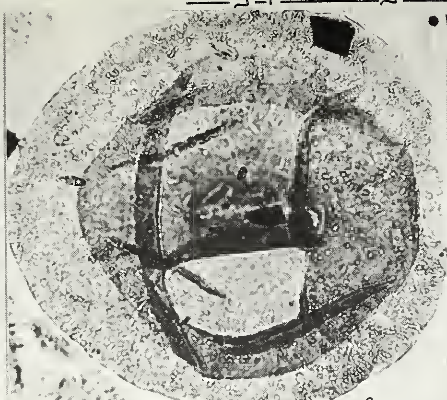
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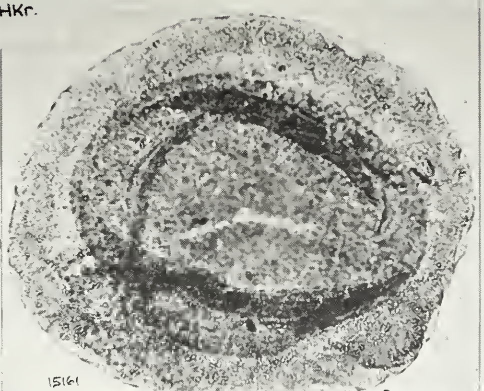
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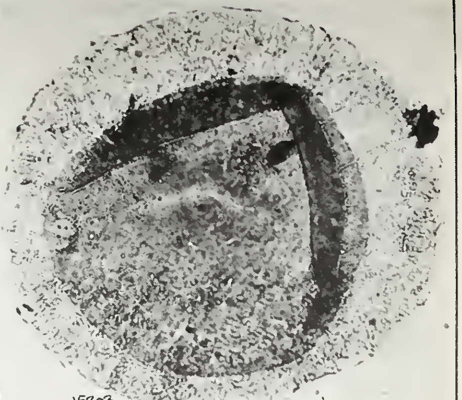
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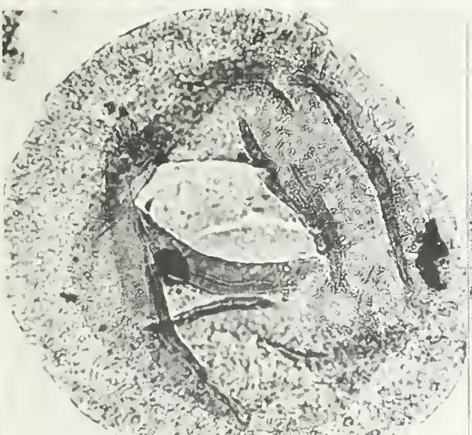
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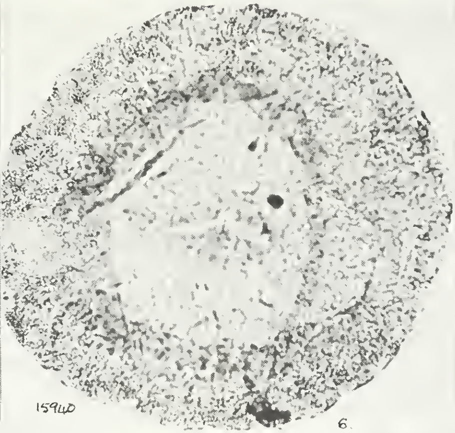
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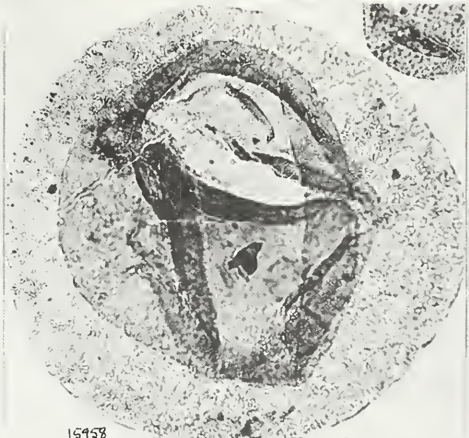
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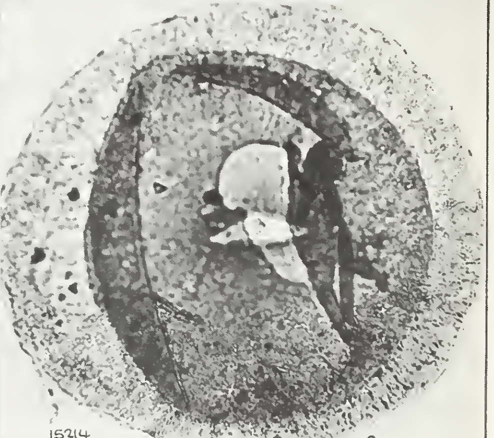
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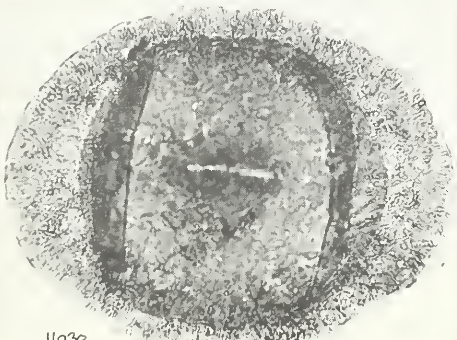
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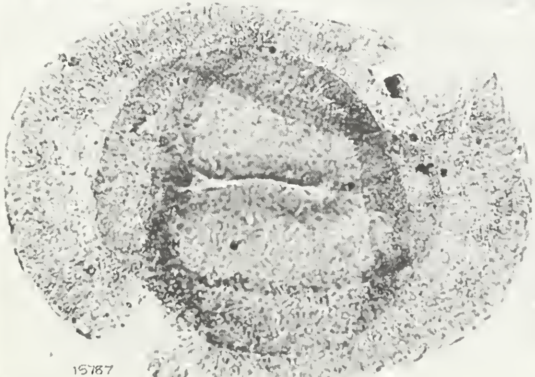
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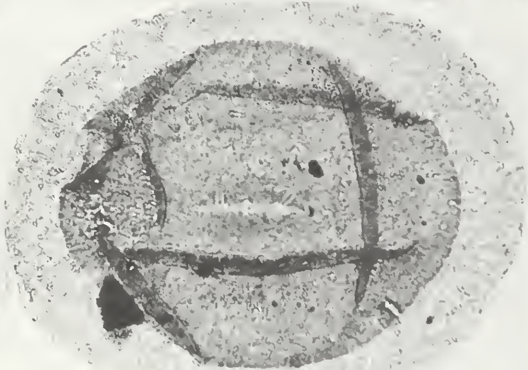
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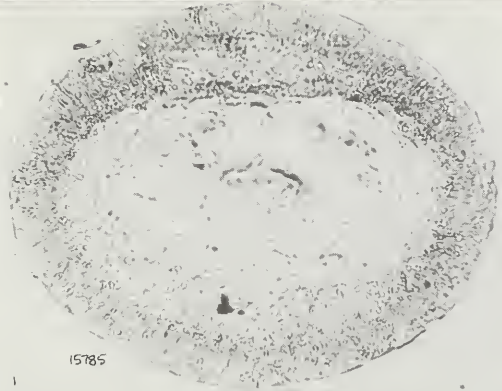
Vestigisporites neglectus (Pot. + Lele '61) comb. nov.

● HKr.



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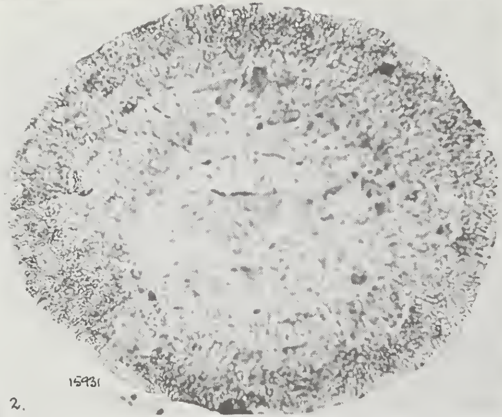

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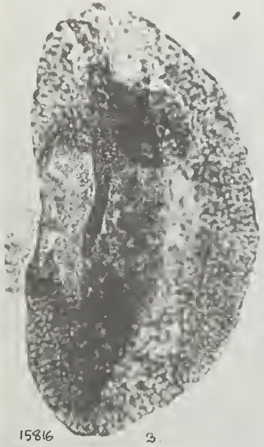

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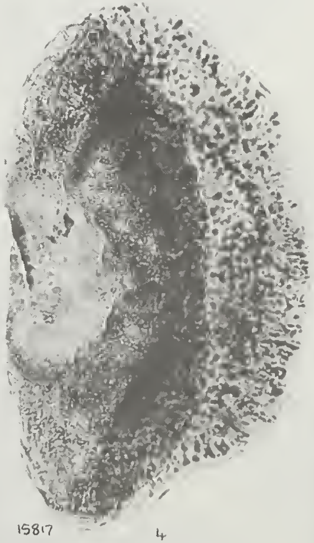

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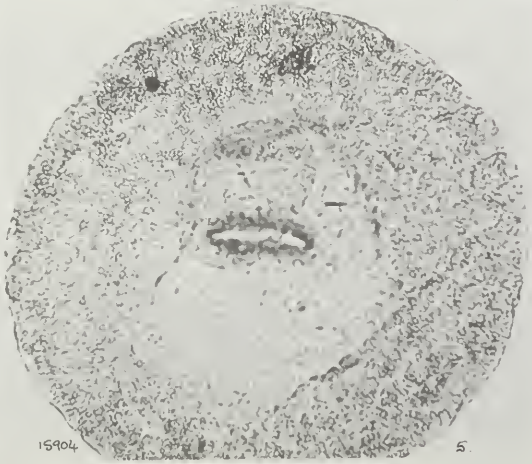

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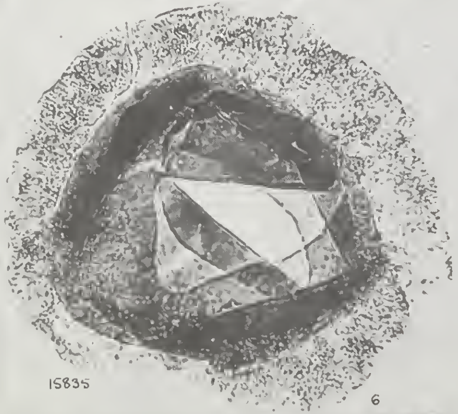

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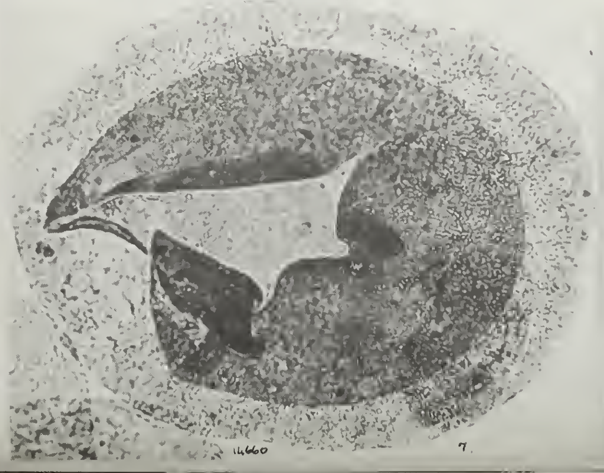

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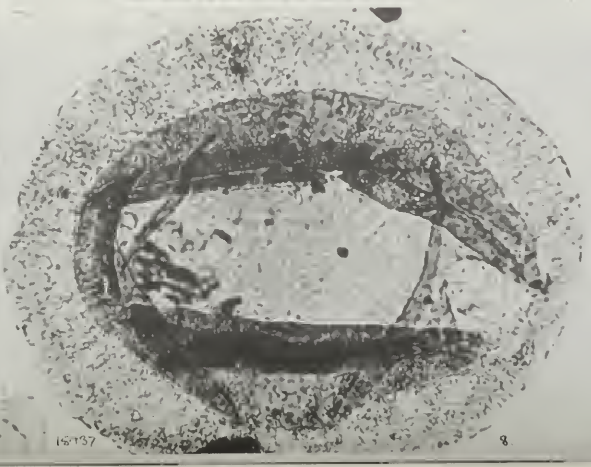

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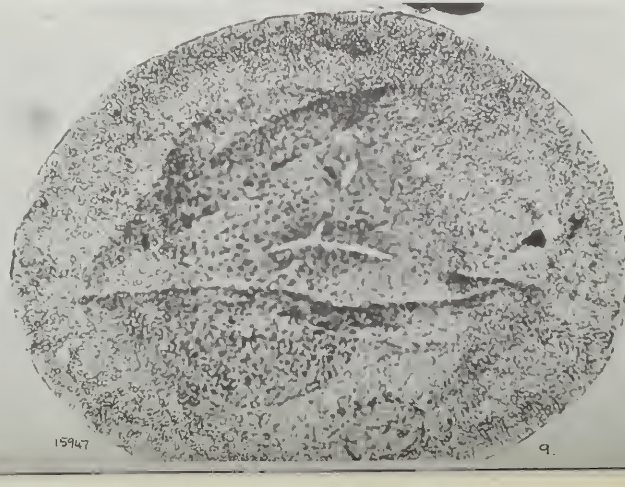
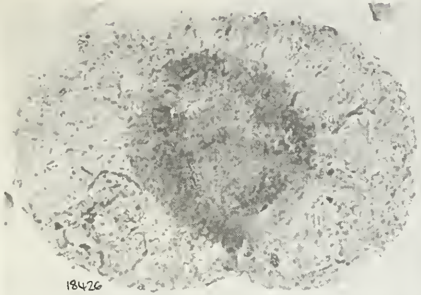


15947 9.

Vestigisporites walikalensis (Hoeg + Bose '60) comb. nov.

● OW 1145'



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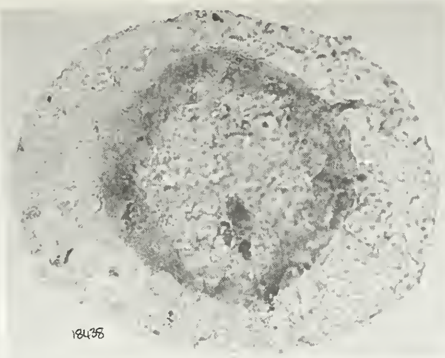

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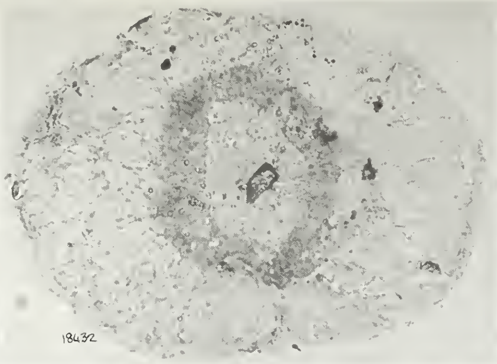

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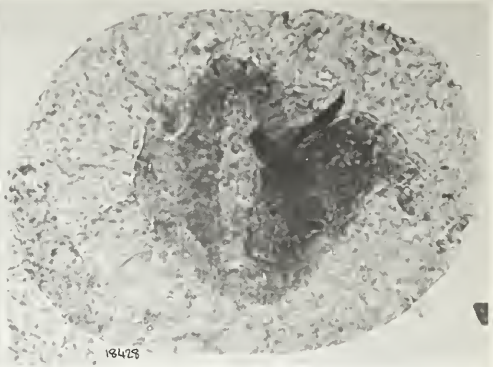

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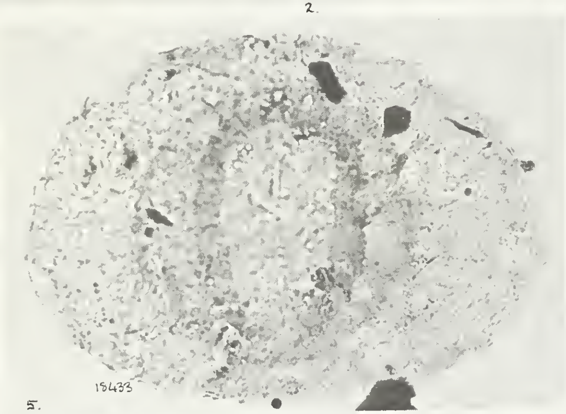

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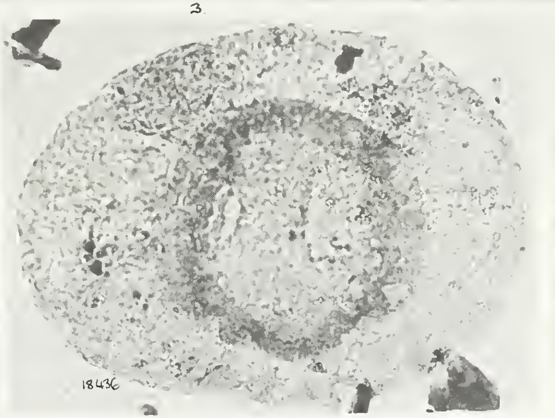

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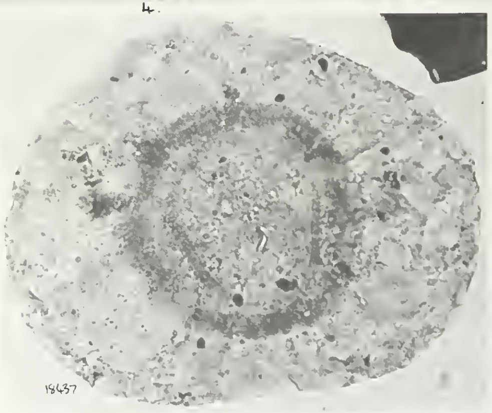

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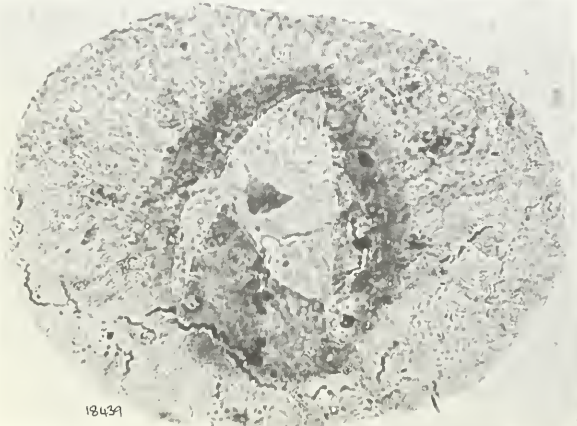

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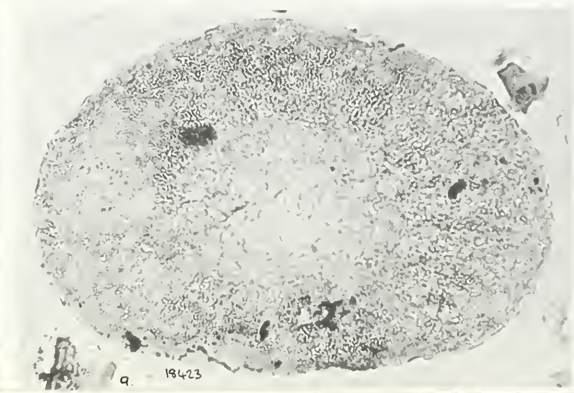

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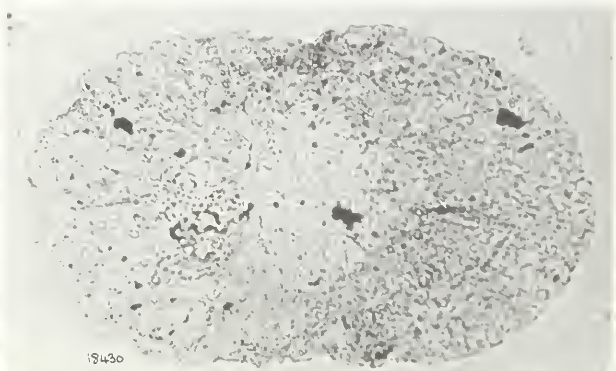
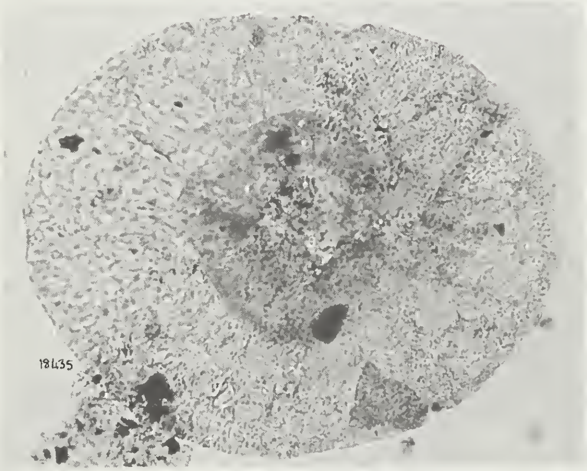


10.

Vestigisporites walikalensis (Hoeg & Bose '60) comb nov.

● OW 1145'



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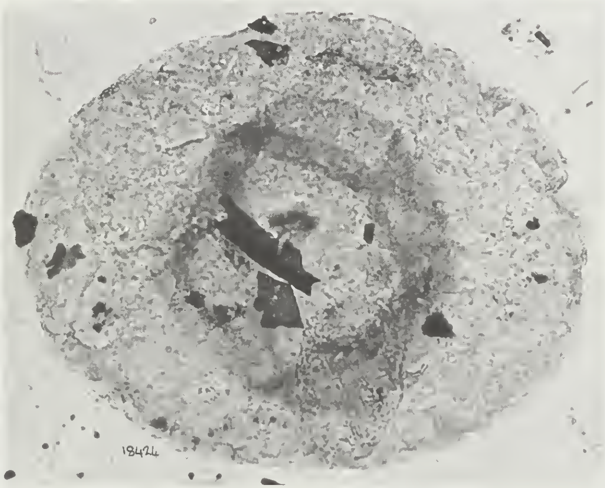

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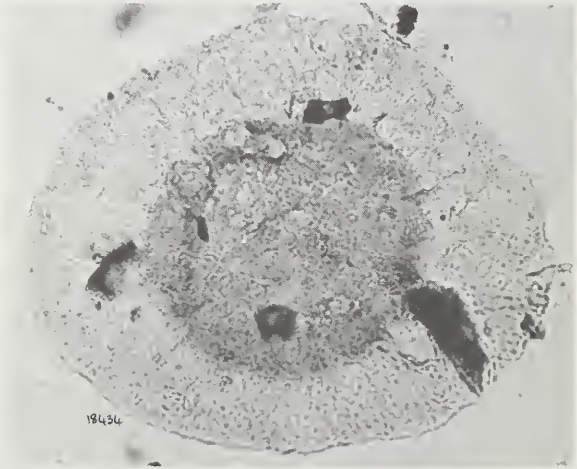

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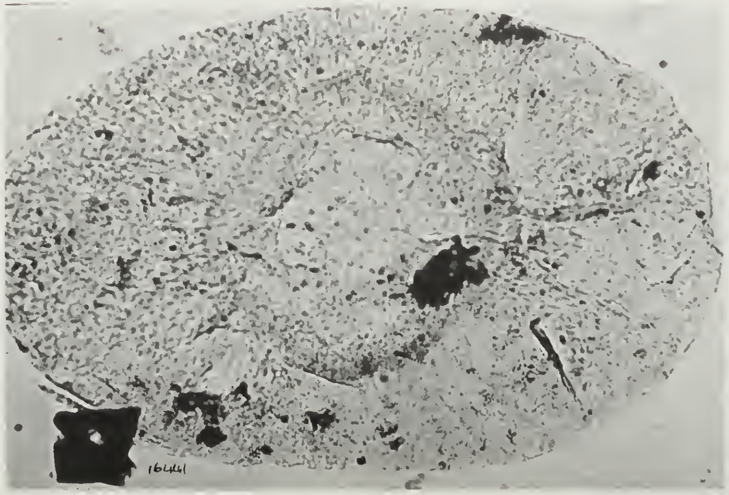
○ UC 678 80,6



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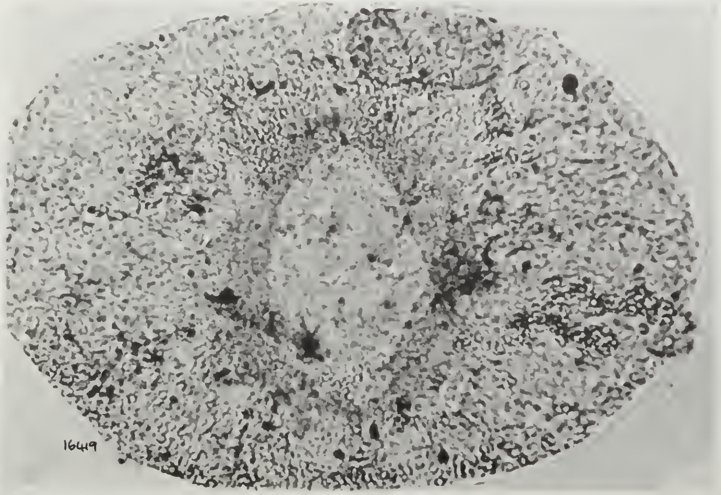

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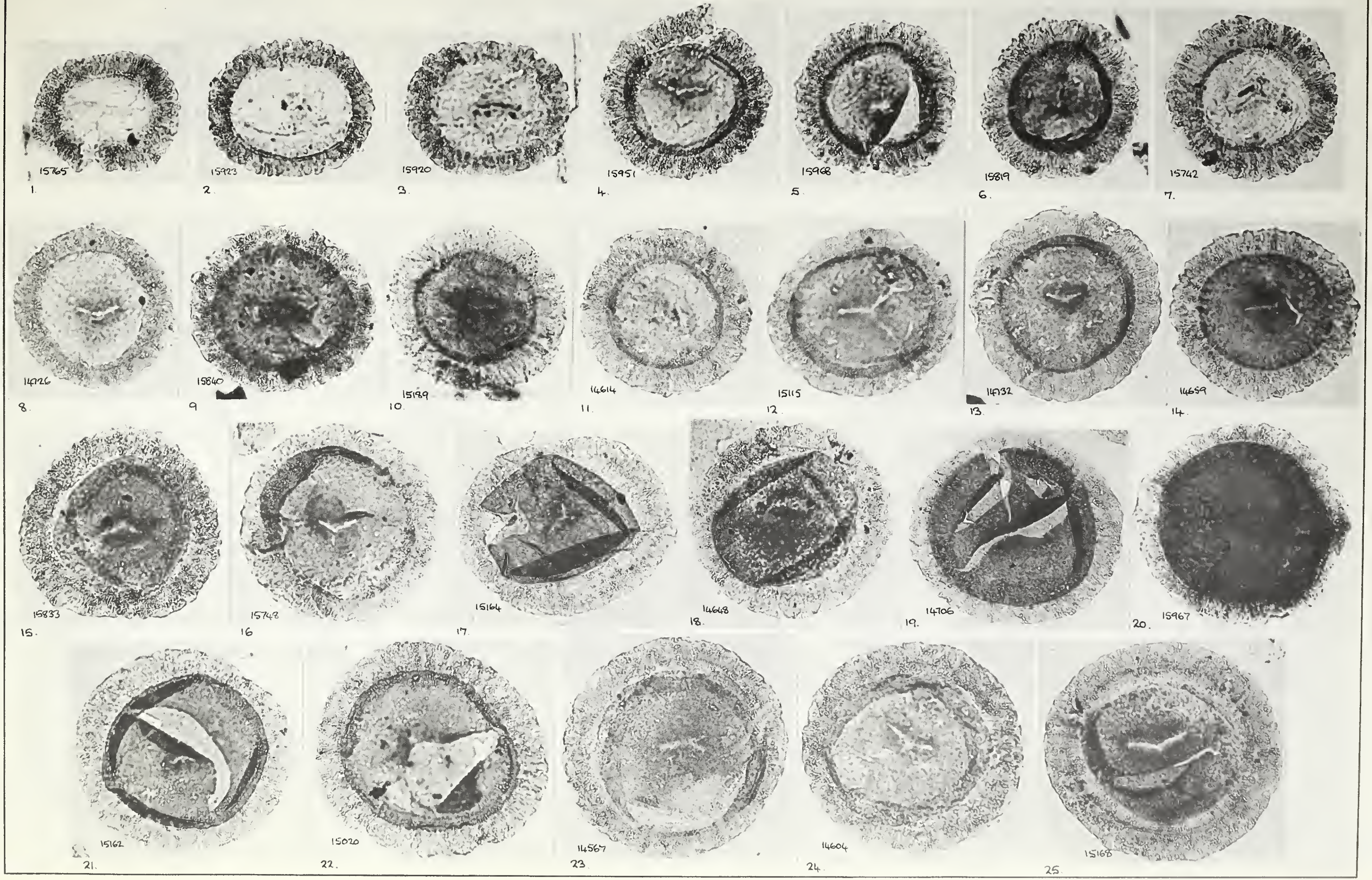
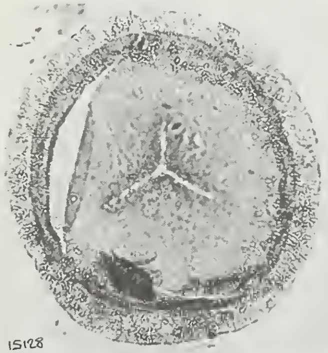
Vestigisporites karharbarensis (Maithy'65) comb.nov.

• HKr.



Vestigisporites karharbarensis (Maithy'65) comb. nov.

● HKr.



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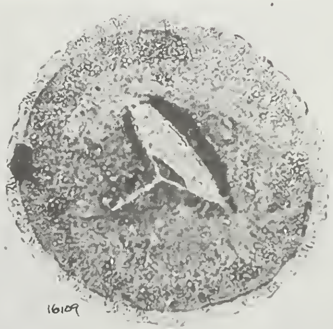

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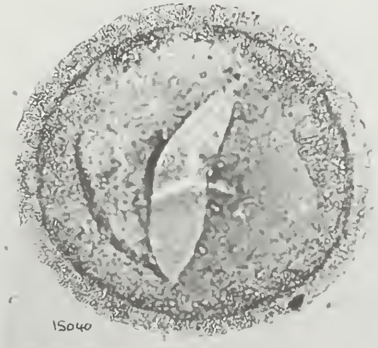

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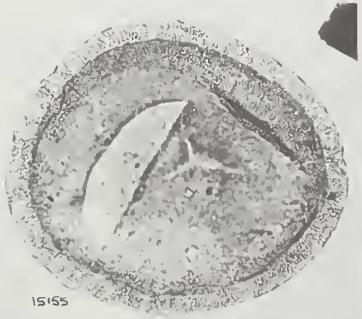

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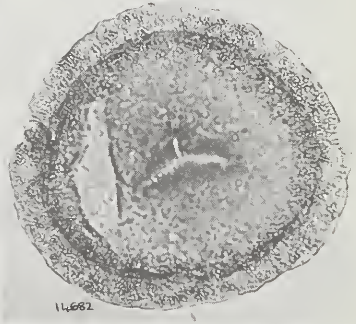

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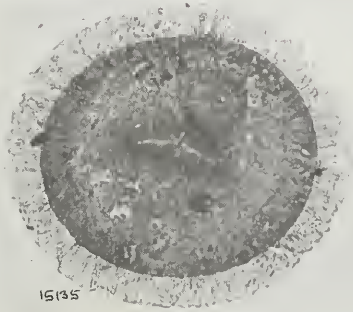

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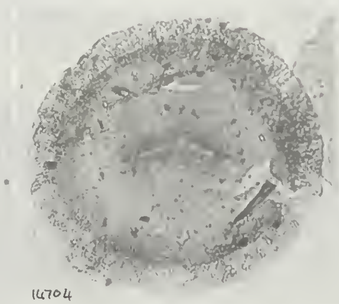

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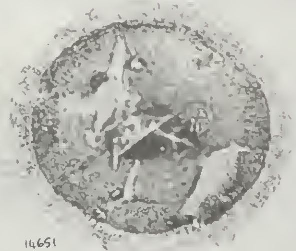

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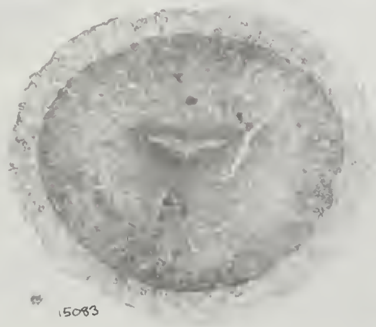

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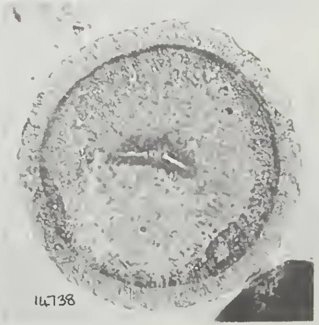

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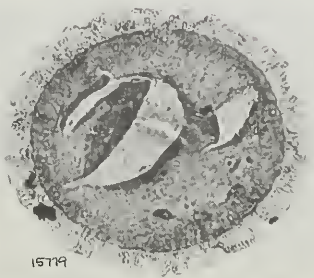

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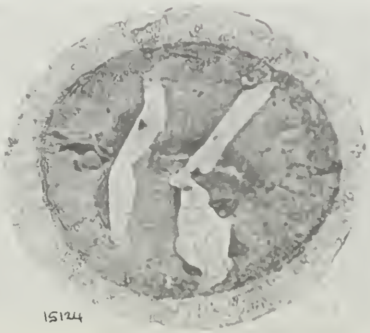

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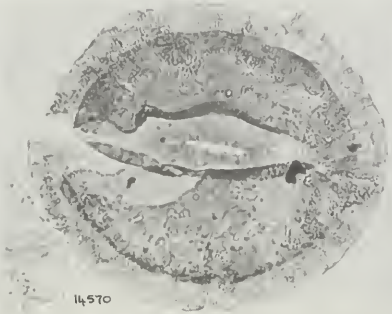

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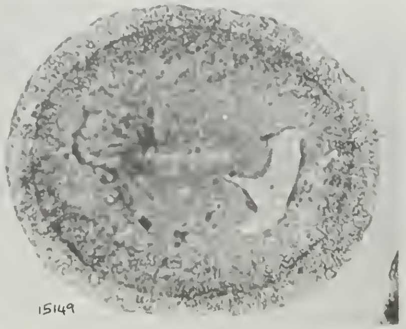
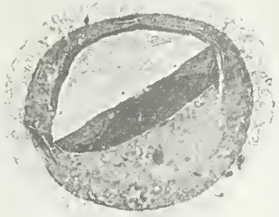


14.

Vestigisporites karharbarensis (Maithy '65) comb. nov.

● HKr.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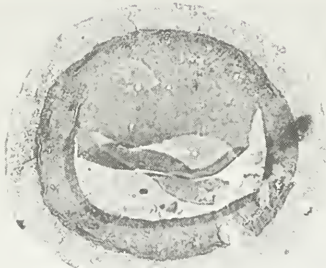
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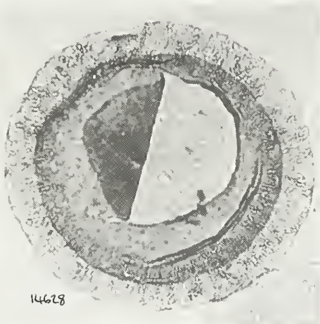
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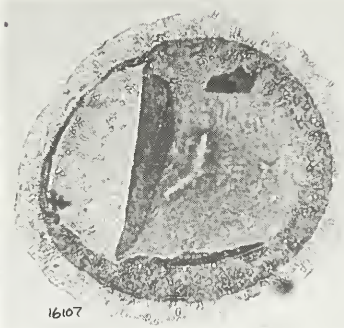
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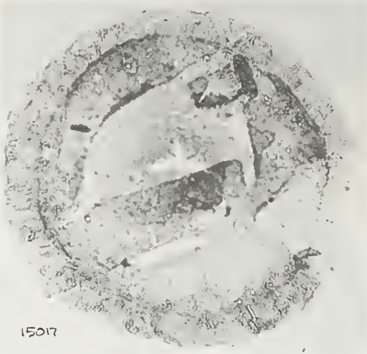
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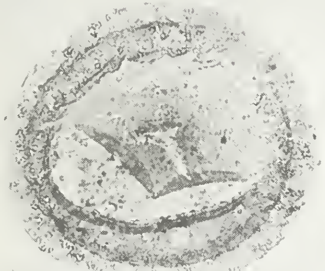
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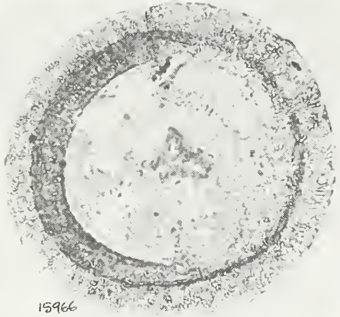
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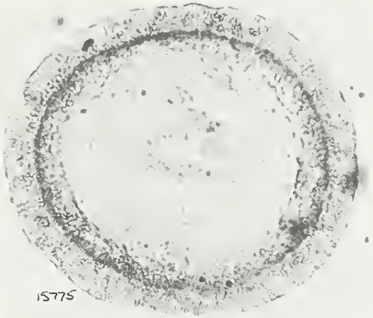
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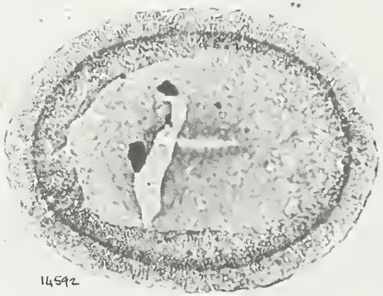
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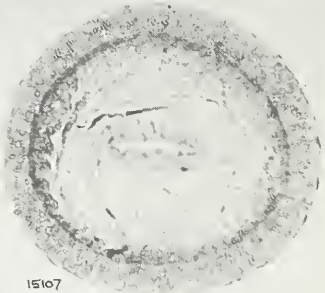
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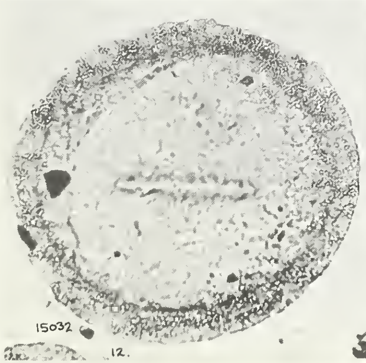
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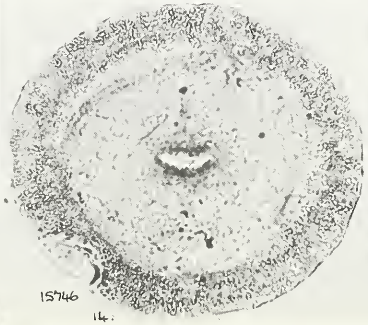
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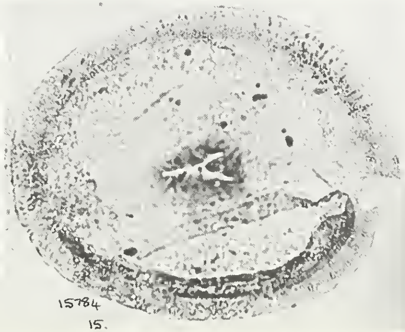
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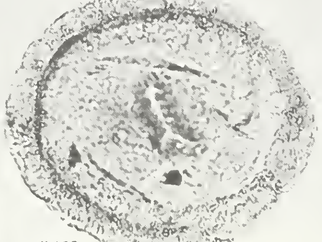
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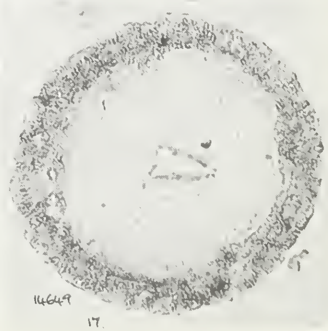
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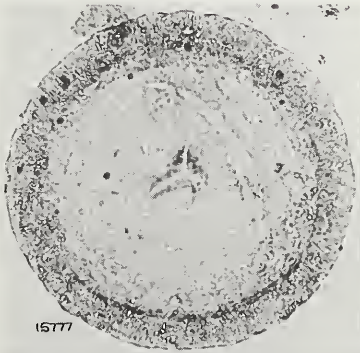
Vestigisporites karharbarensis (Maithy '65) comb. nov.

● HKr.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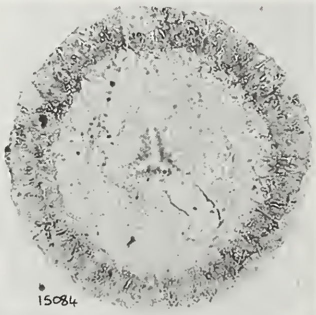
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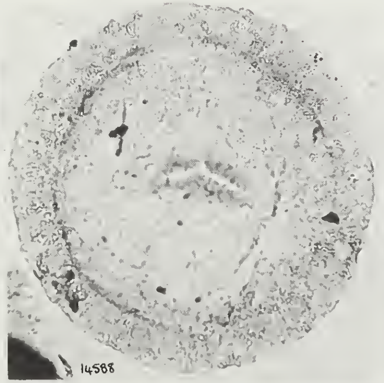
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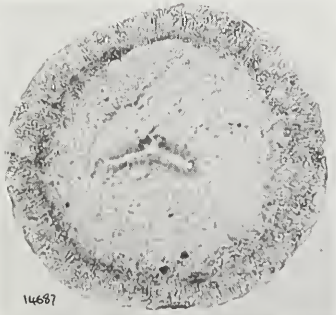
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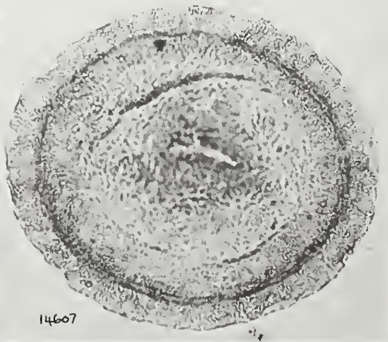
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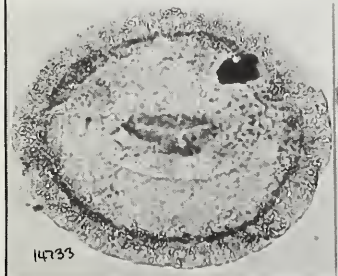
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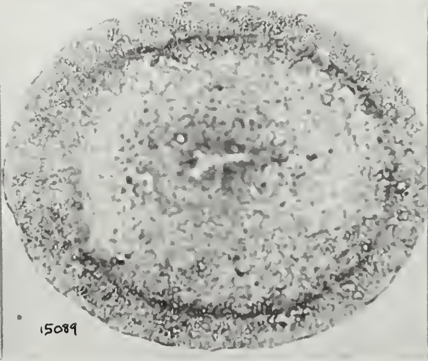
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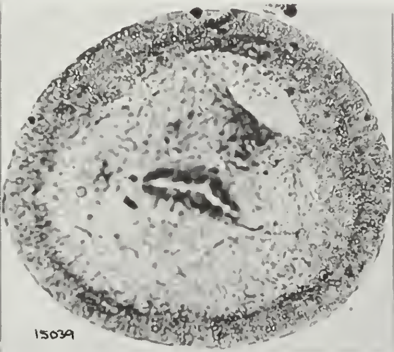
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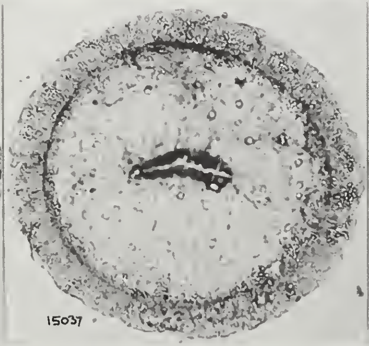
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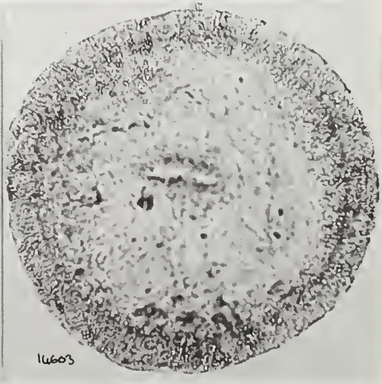
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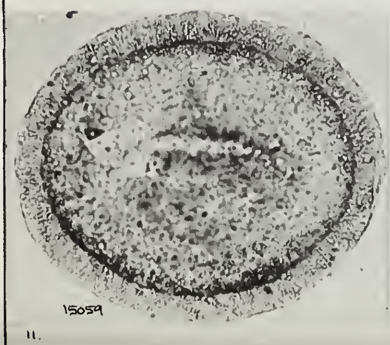
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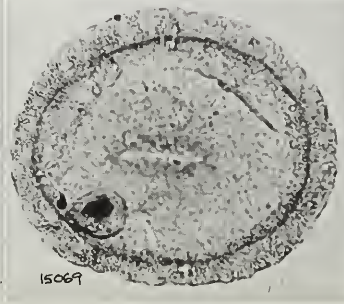
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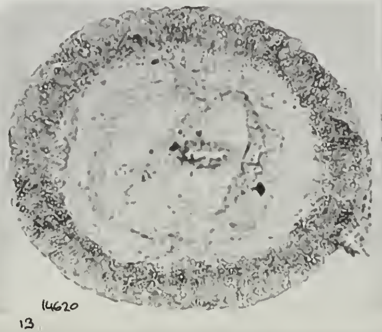
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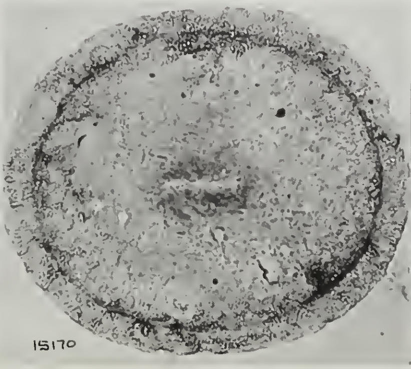
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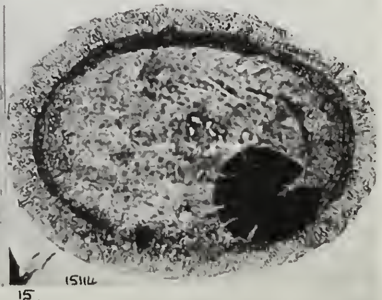
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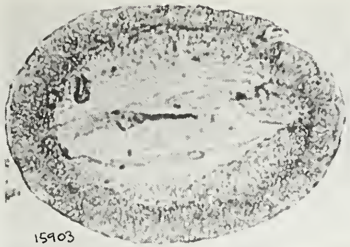
15.

Vestigisporites karharbarensis (Maithy'65) comb. nov.

● HKr.



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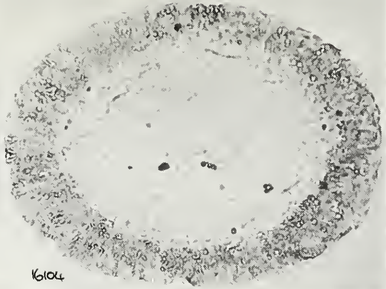

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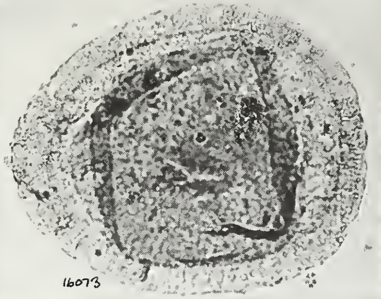

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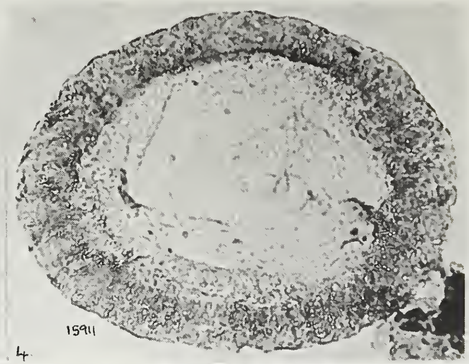

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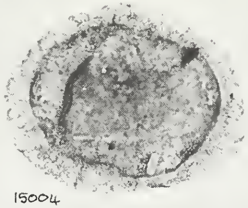

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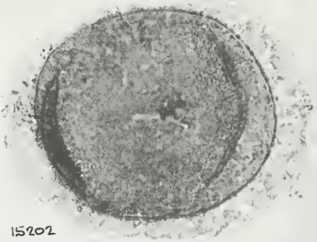

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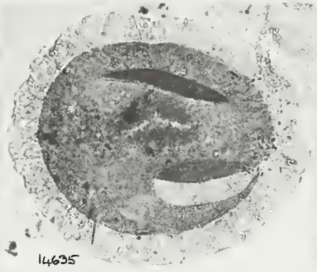

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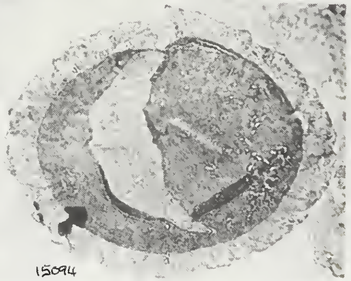

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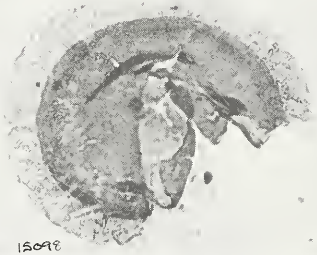

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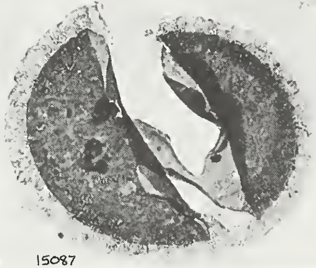

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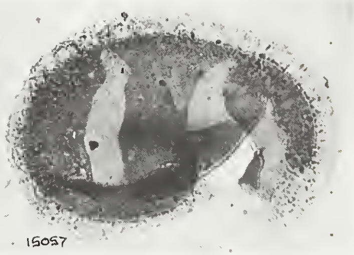

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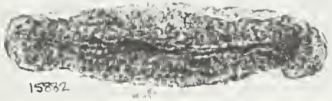

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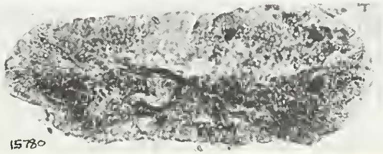

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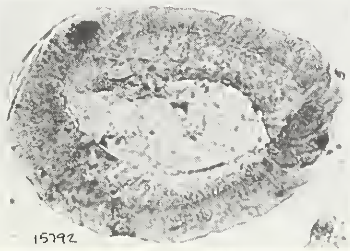

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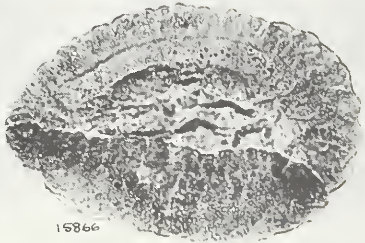

16.

Vestigisporites karharbarensis (Maithy '65) comb. nov.

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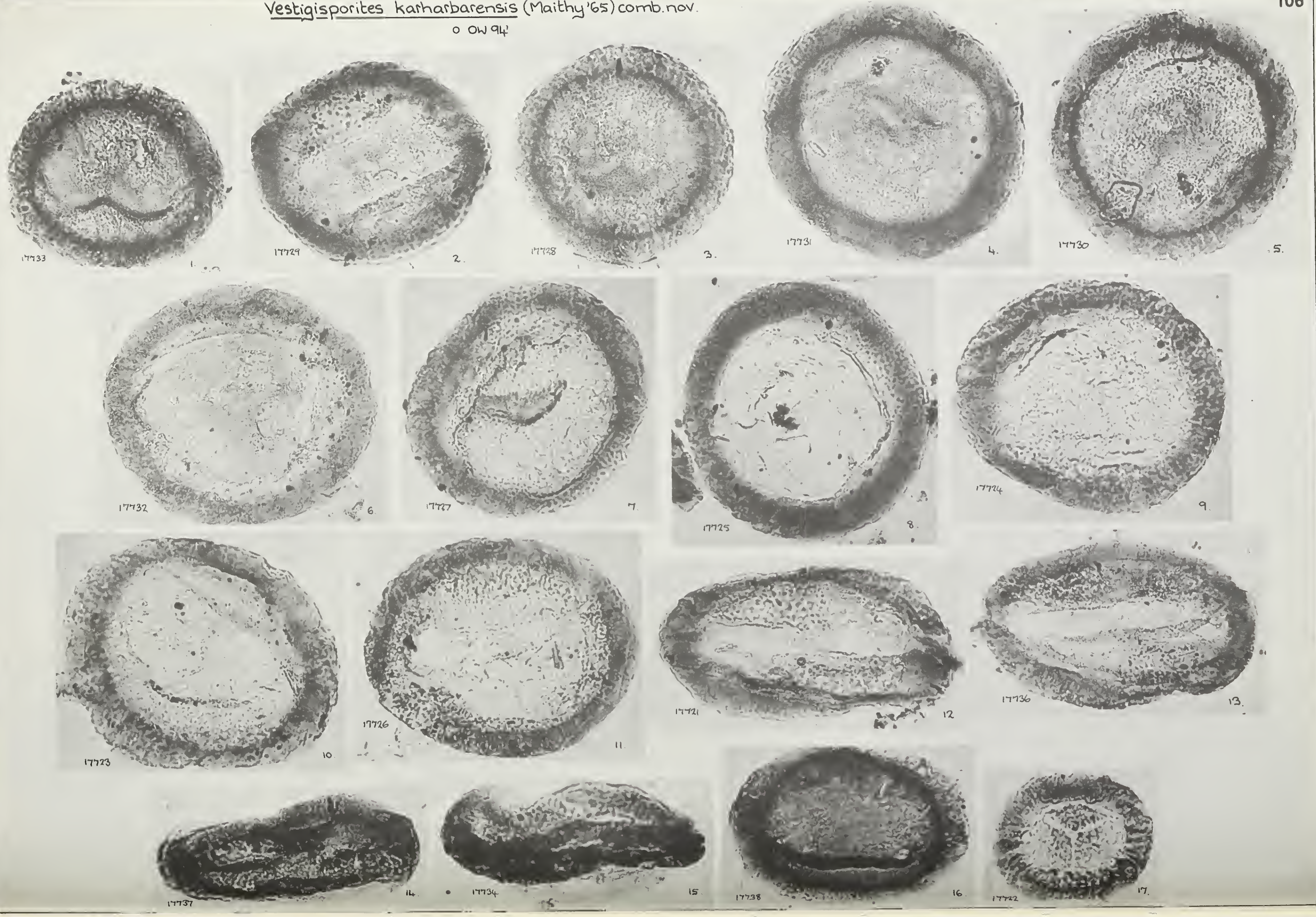
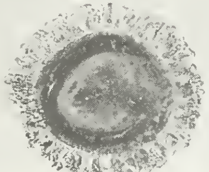


Vestigisporites gondwanensis (Balme & Henn.'56) comb.nov.

● HKr.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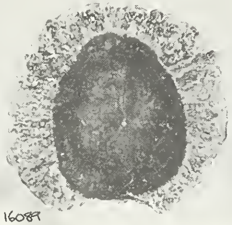
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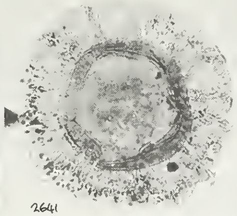
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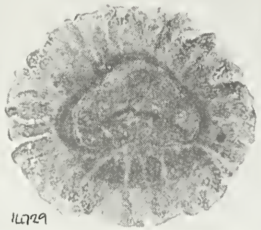
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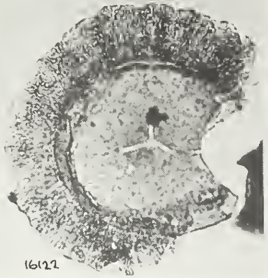
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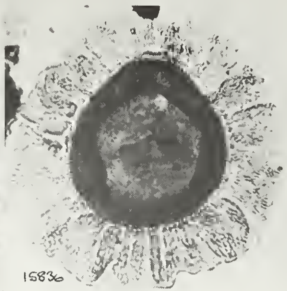
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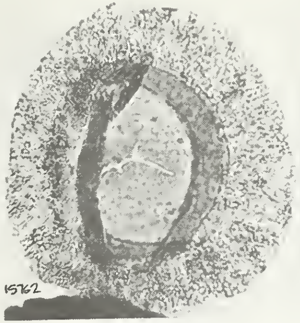
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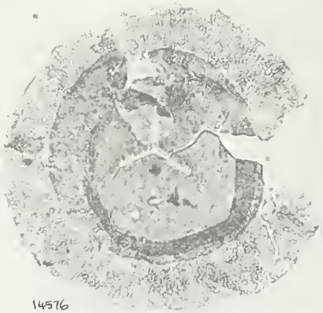
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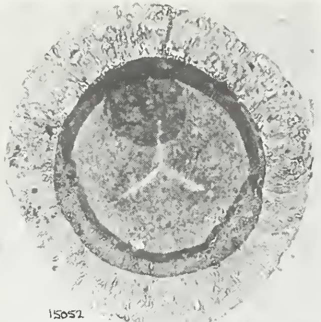
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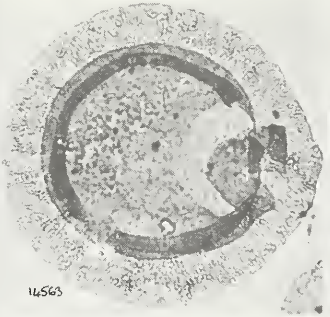
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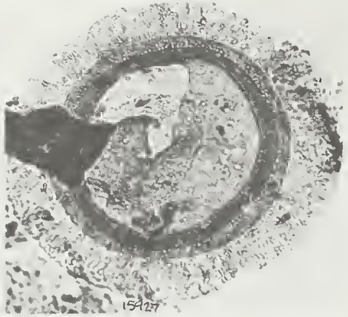
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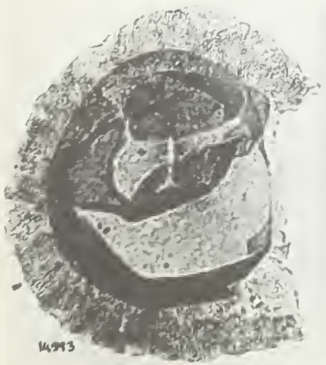
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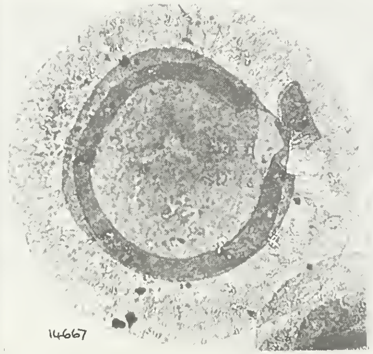
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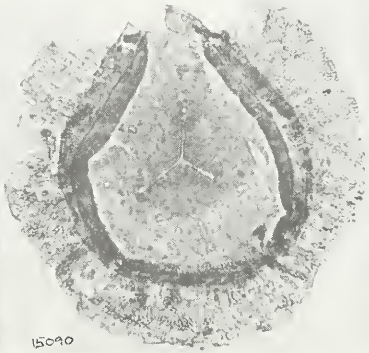
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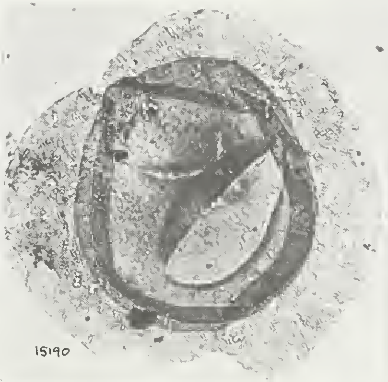
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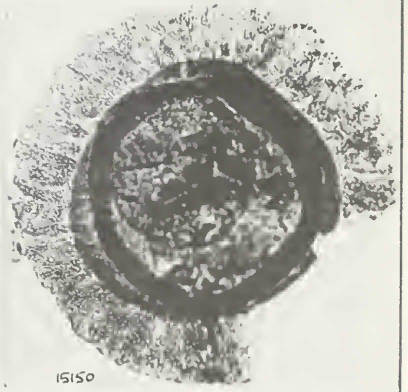
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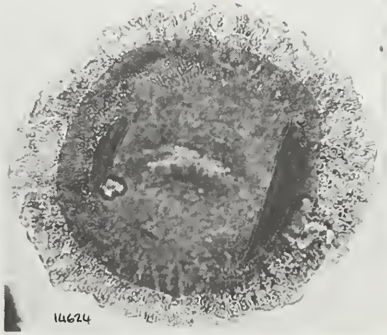
16

Vestigisporites gondwanensis (Balme + Henn.'56) comb.nov.

● HKr.



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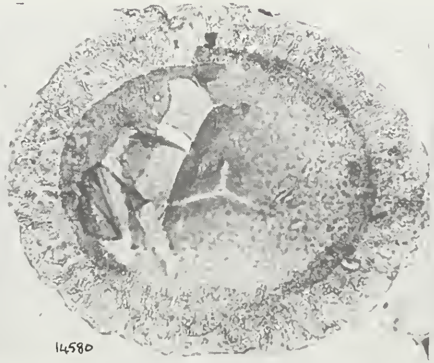

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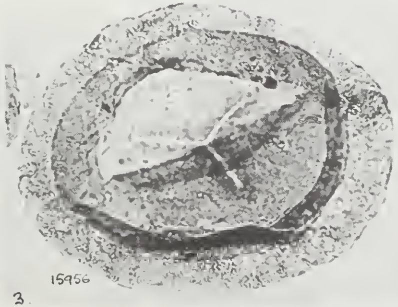

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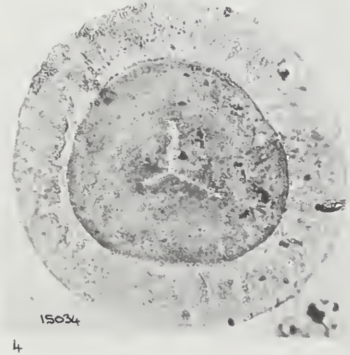

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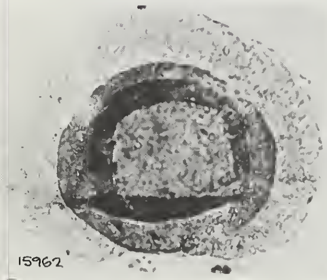

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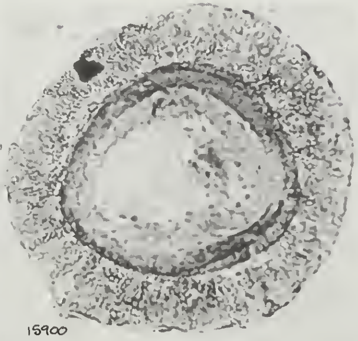

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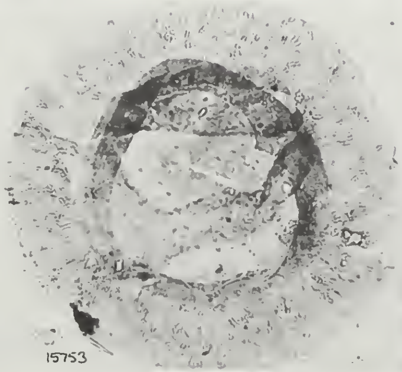

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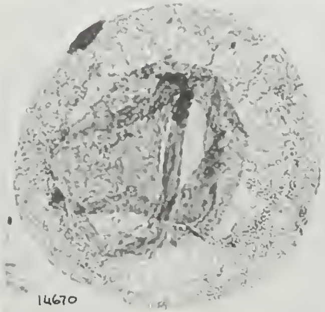

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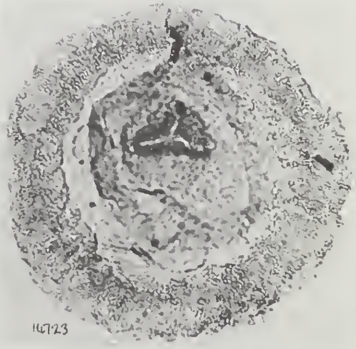

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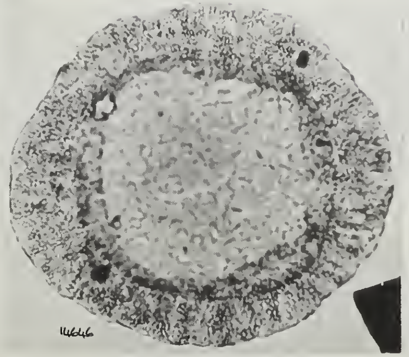

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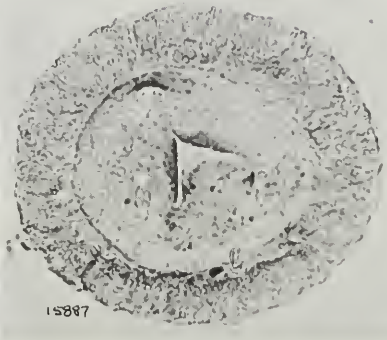

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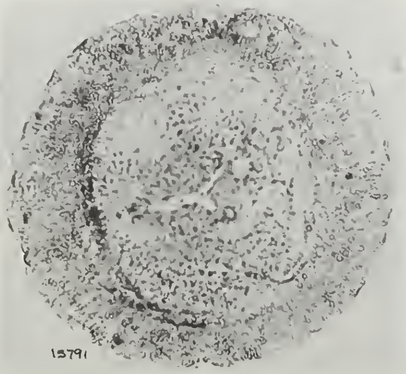

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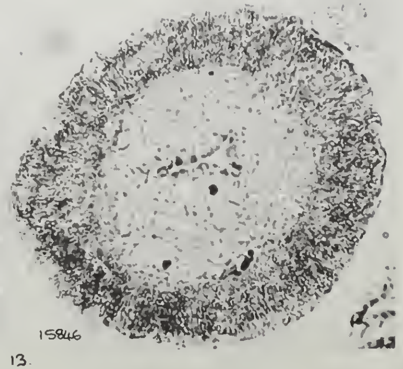
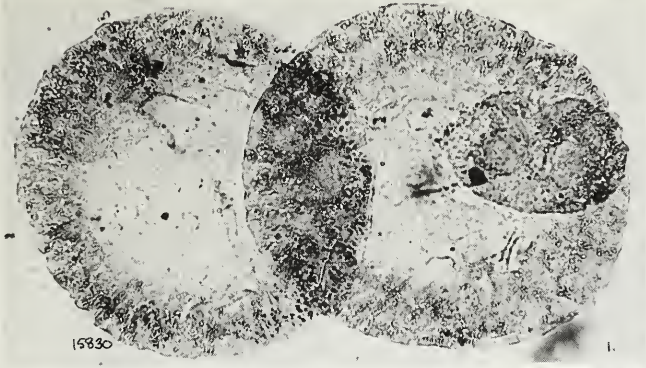


13.

Vestigisporites gondwanensis (Balme & Henn.'56) comb. nov.

● HKr.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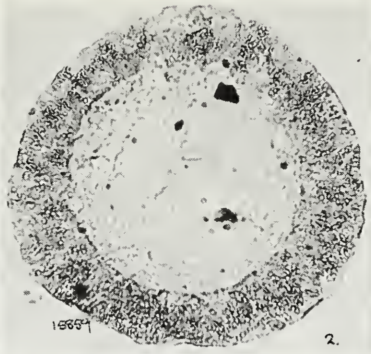
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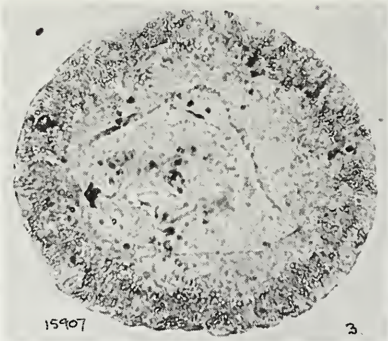
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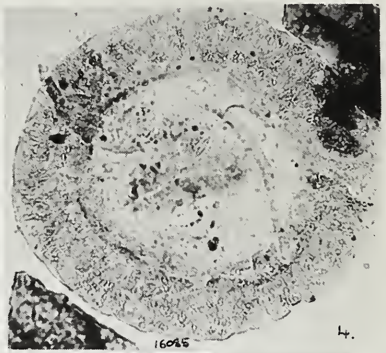
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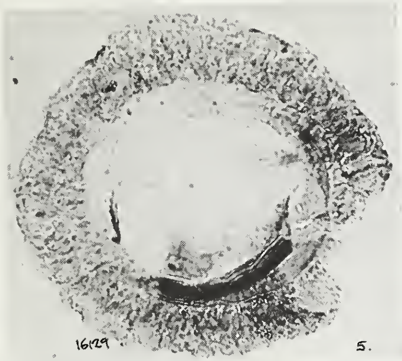
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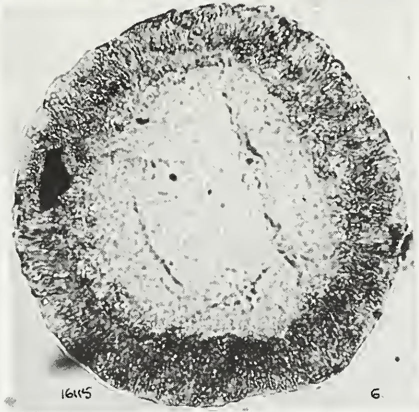
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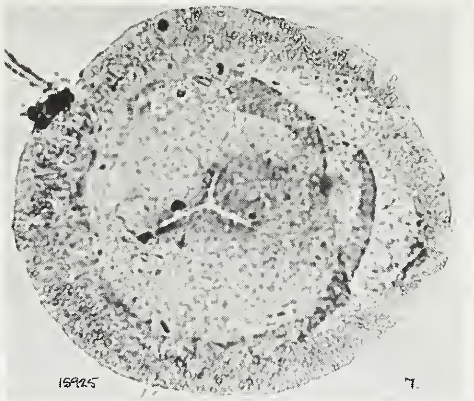
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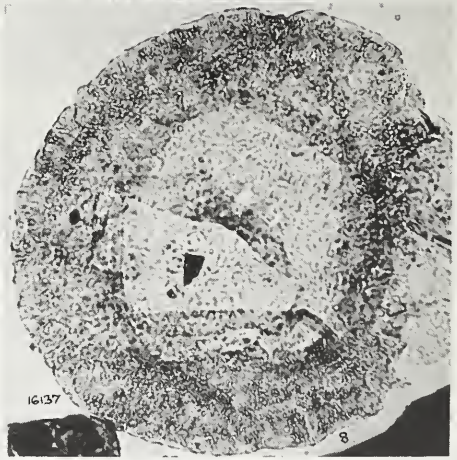
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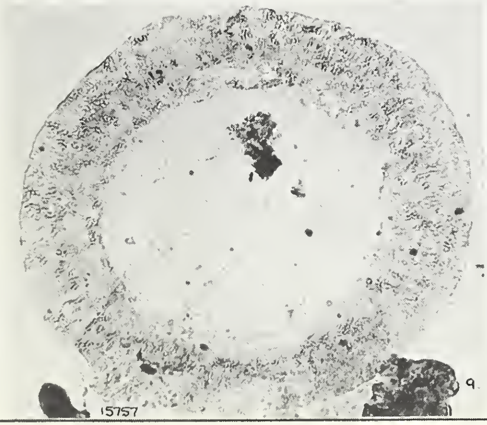
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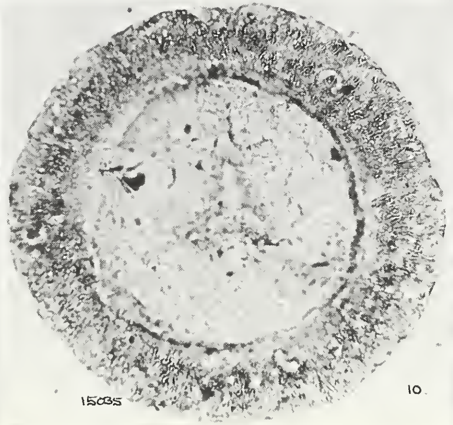
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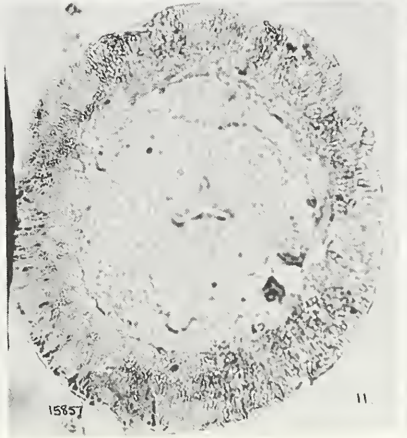
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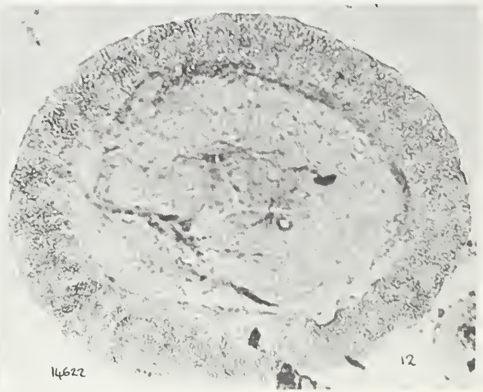
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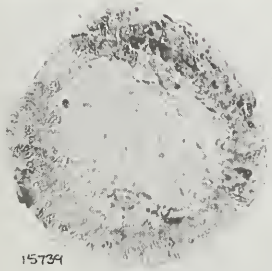
Vestigisporites gondwanensis (Balme & Henn.'56) comb. nov.

● HKr.



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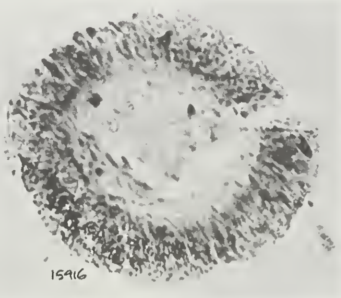

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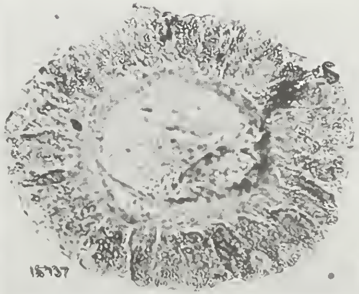

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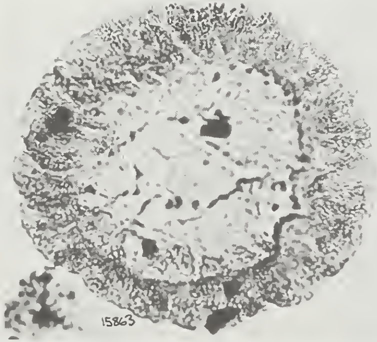

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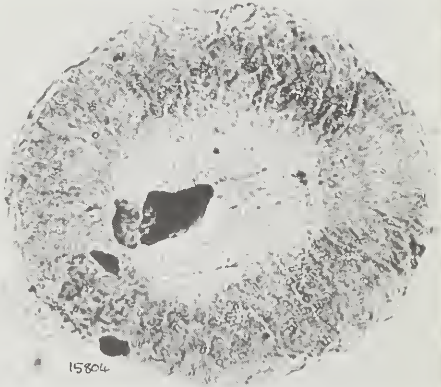

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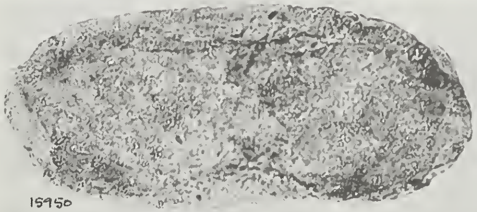

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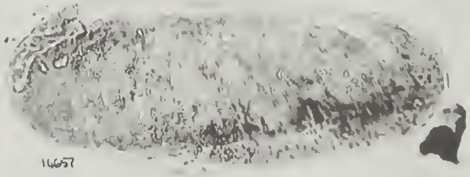

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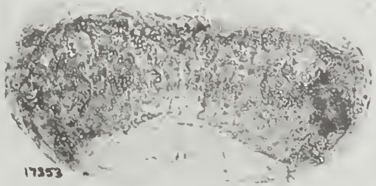

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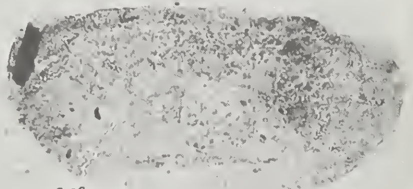

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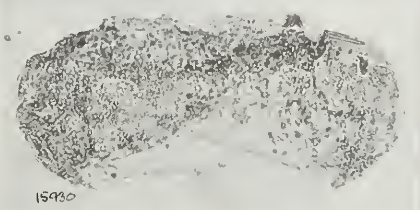

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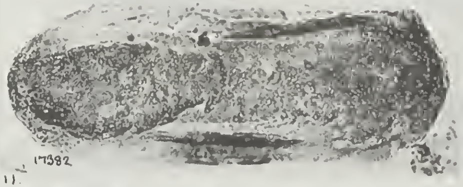

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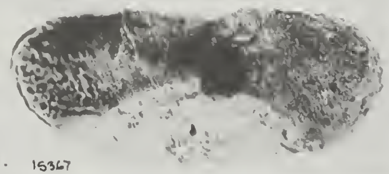

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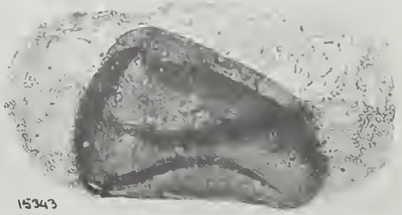

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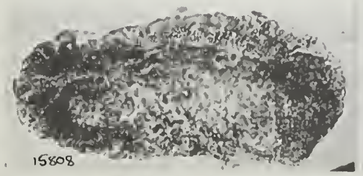

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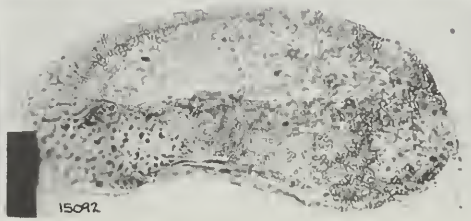

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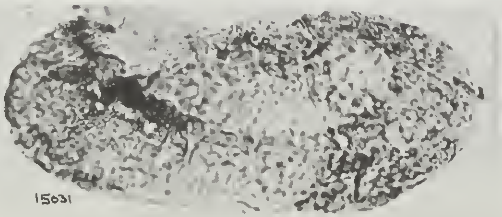

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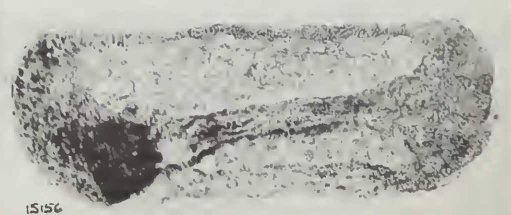
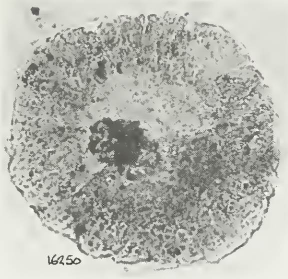


17.

Vestigisporites gondwanensis (Balme + Henn.'56) comb. nov.

o UC 678 79,0



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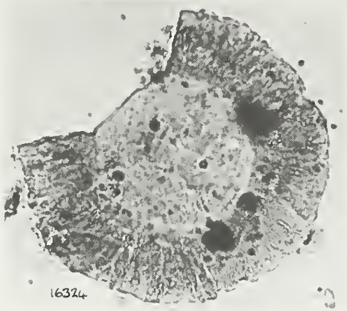

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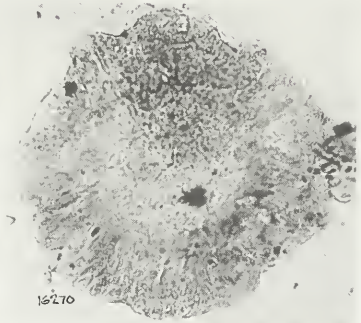

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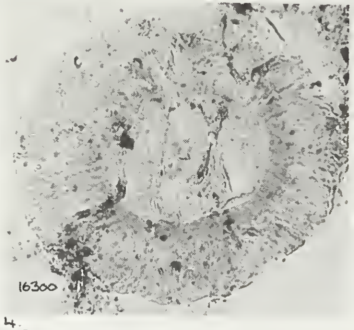

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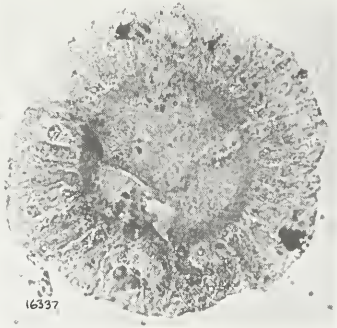

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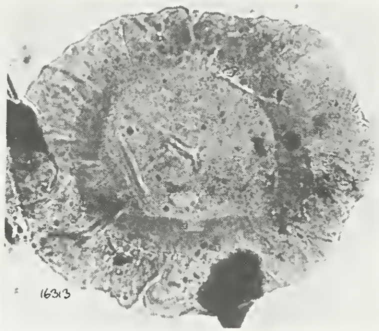

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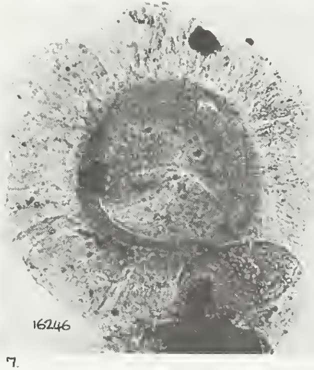

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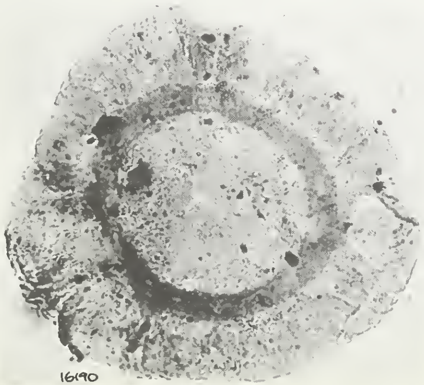

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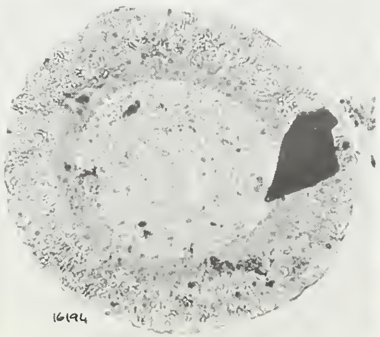

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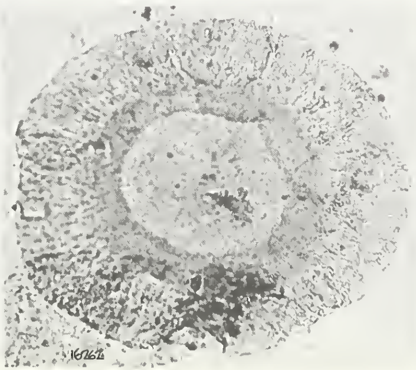

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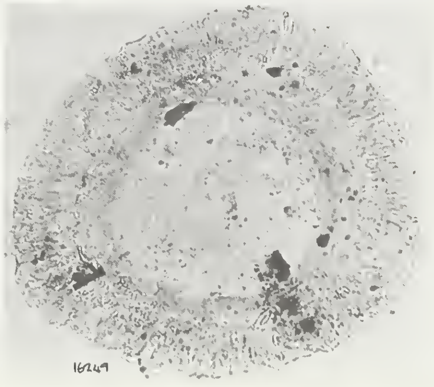
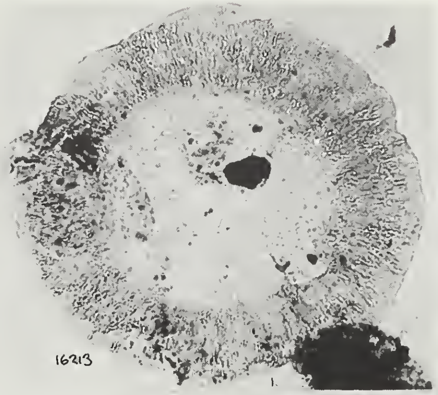


11.

Vestigisporites gondwanensis (Balme & Henn.'56) comb nov.

0 UC 678 79,0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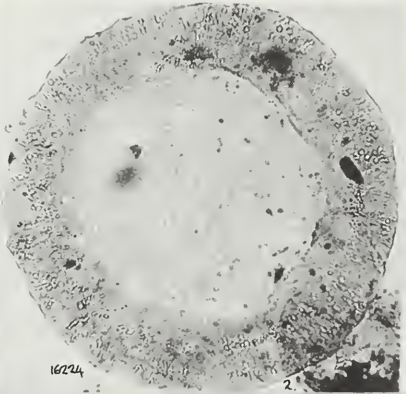
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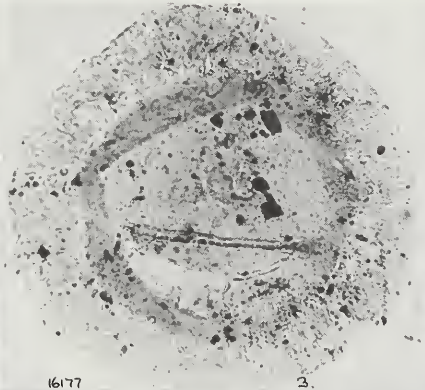
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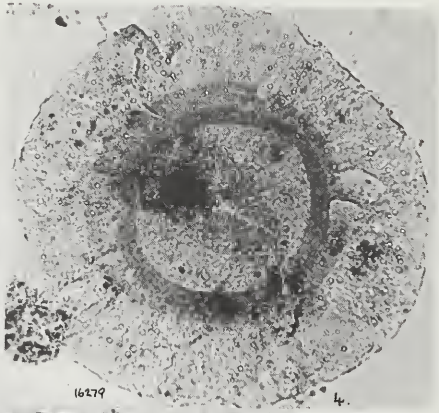
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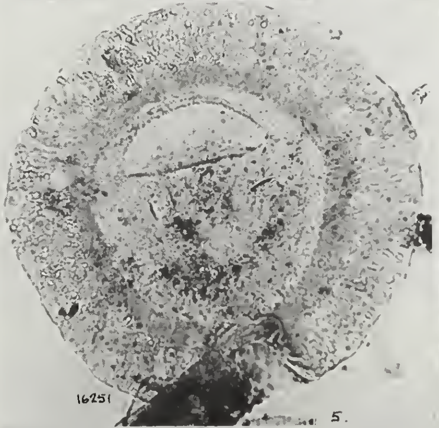
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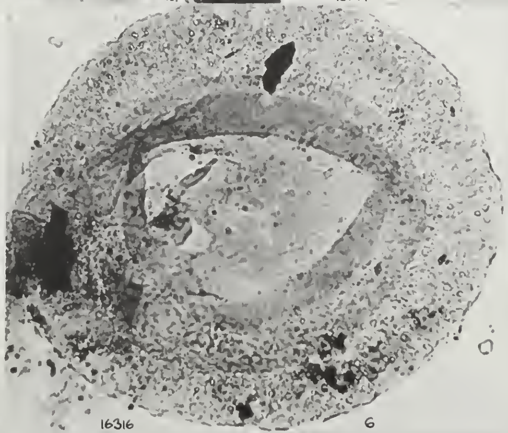
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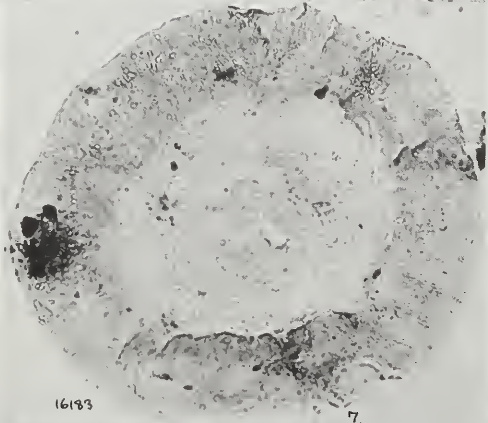
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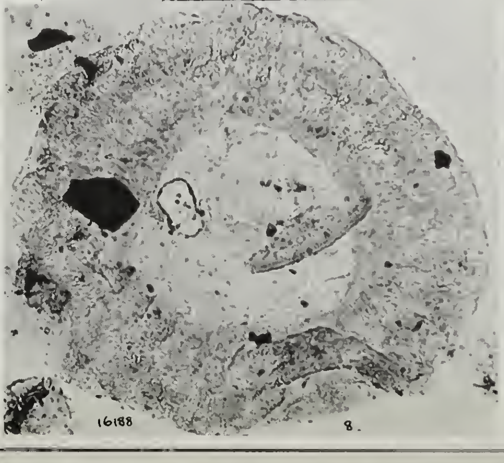
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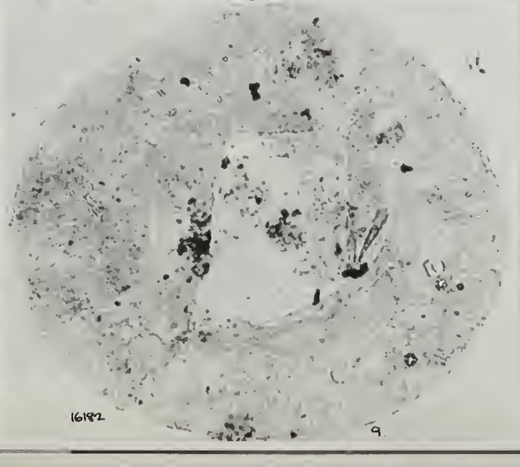
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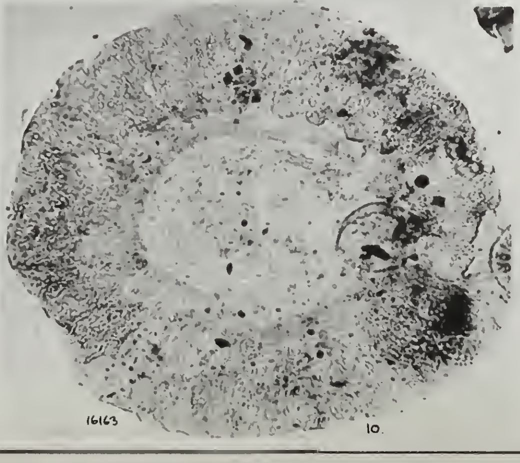
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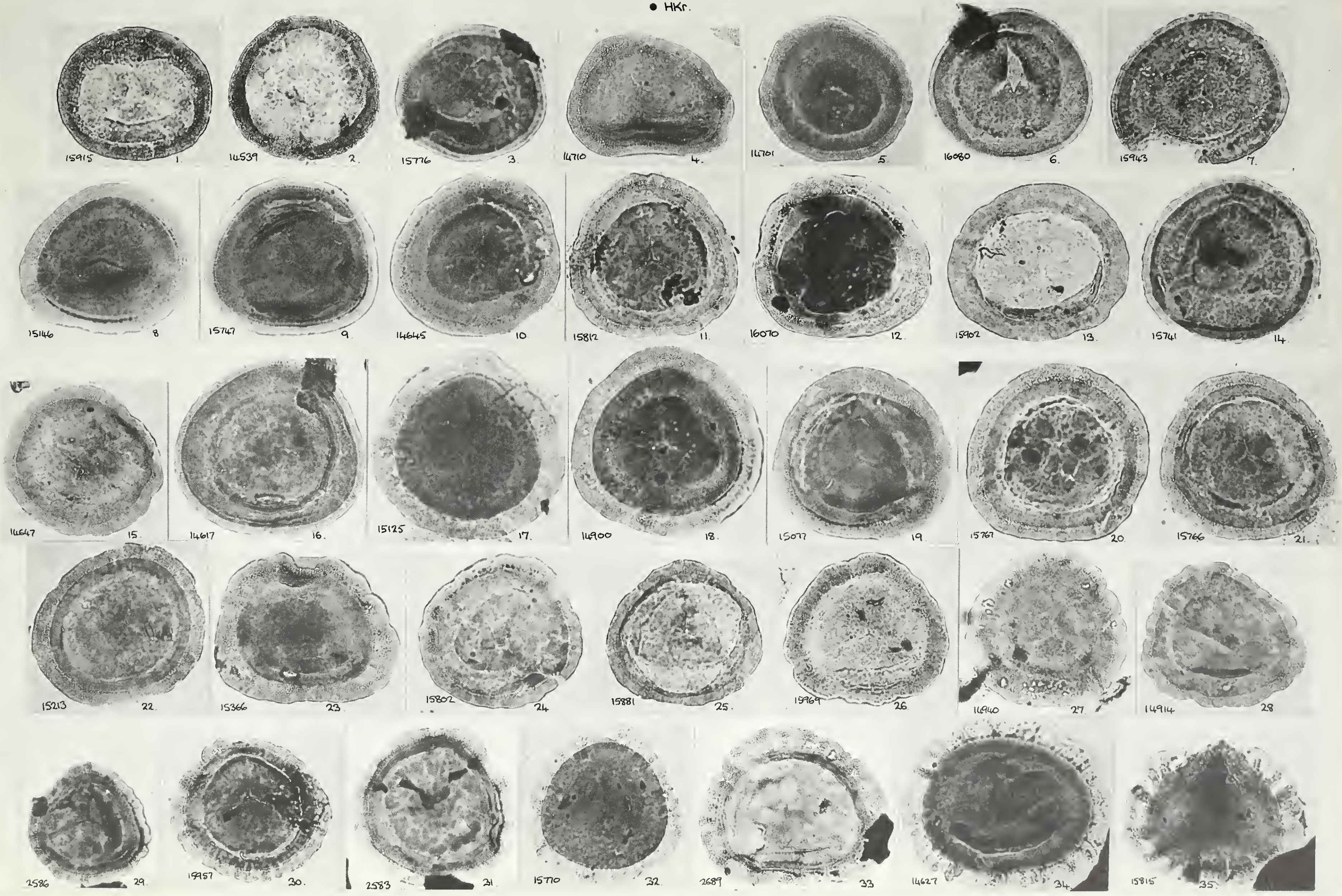
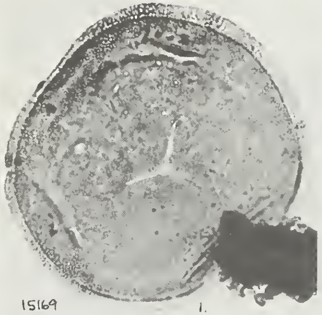
Vestigisporites rotatus (Balme & Henn.'56) comb.nov.

● HKr.



Vestigisporites rotatus (Balme & Henn.'56) comb. nov.
● HKr.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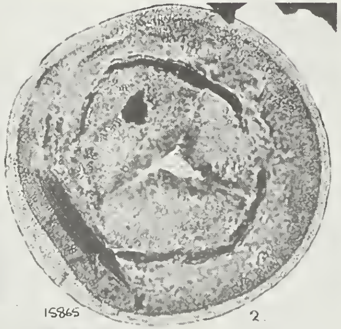
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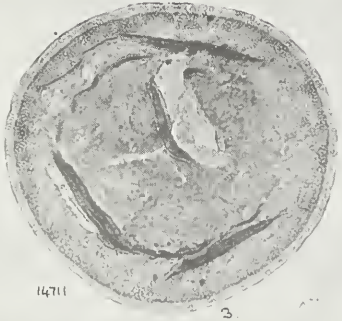
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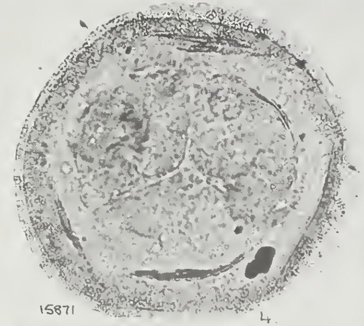
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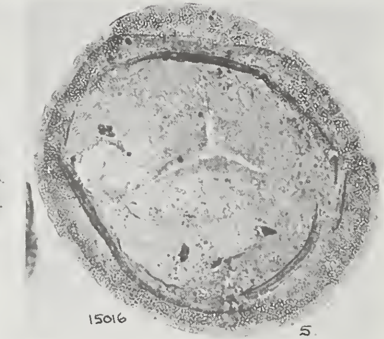
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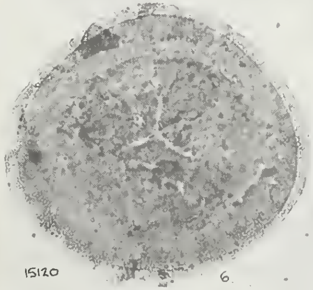
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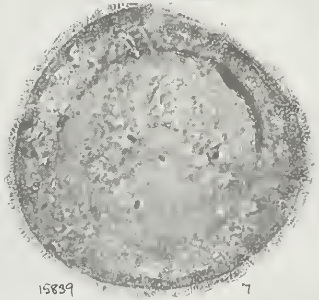
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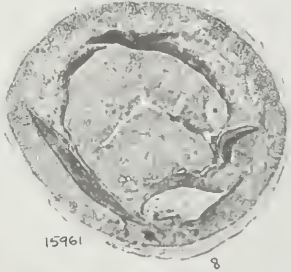
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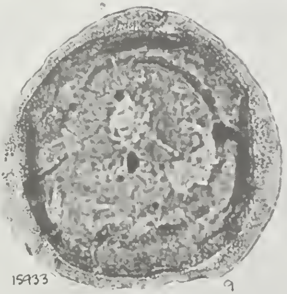
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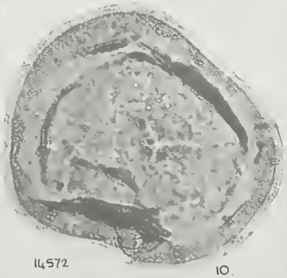
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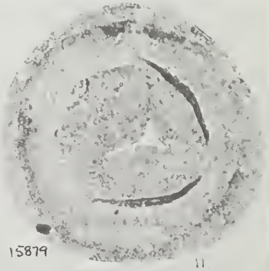
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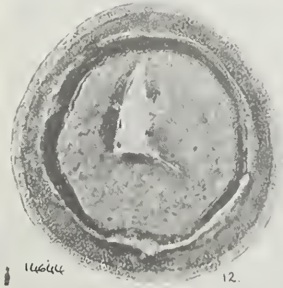
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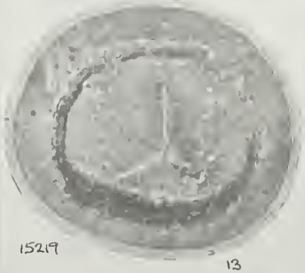
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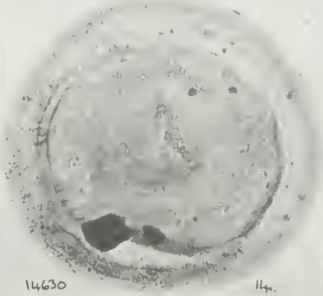
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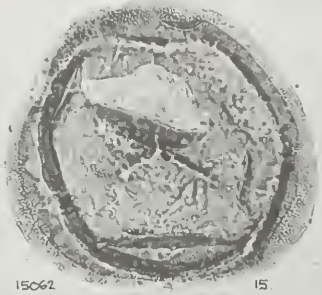
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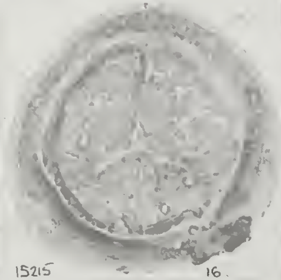
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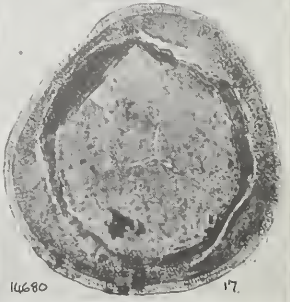
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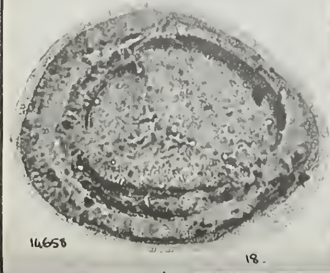
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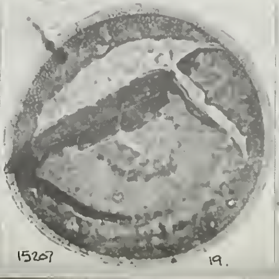
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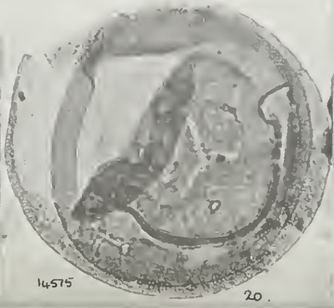
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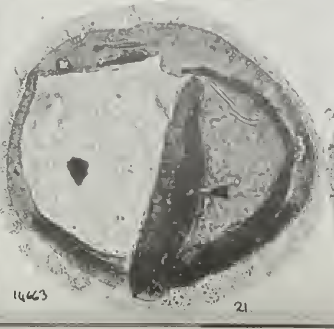
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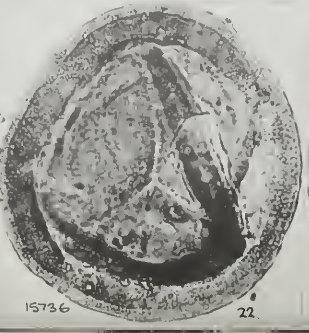
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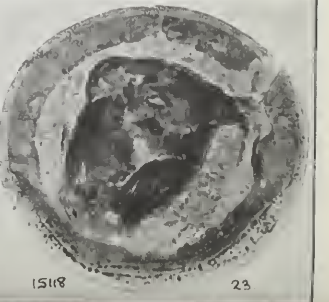
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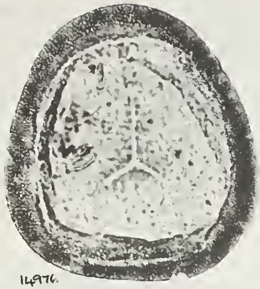
Vestigisporites rotatus (Balme + Henn.'56) comb.nov.

● HKr.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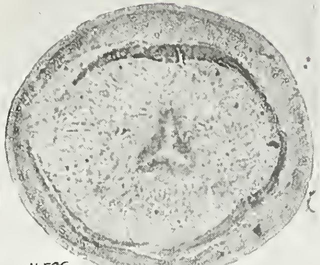
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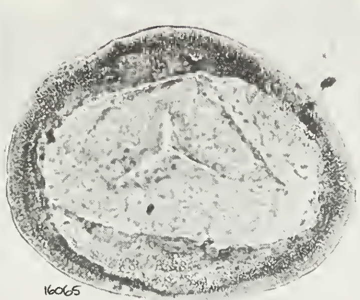
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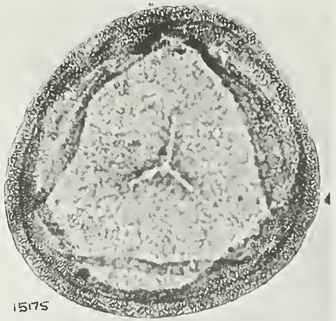
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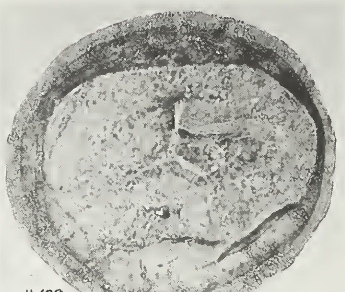
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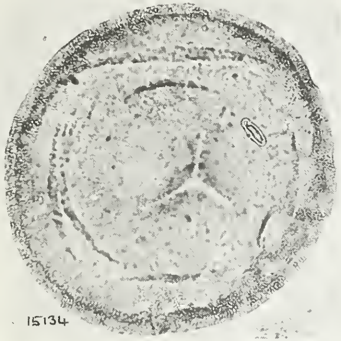
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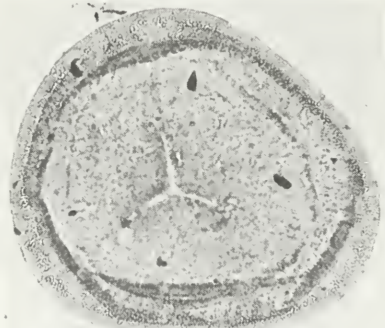
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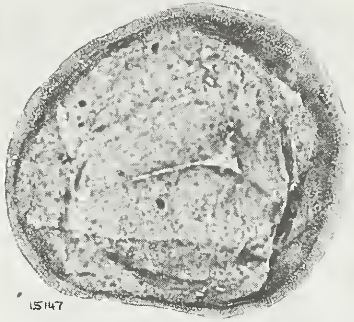
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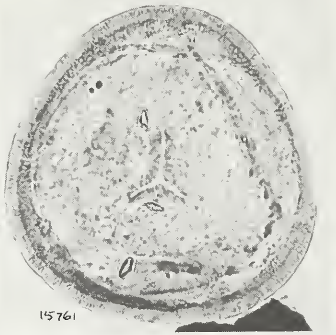
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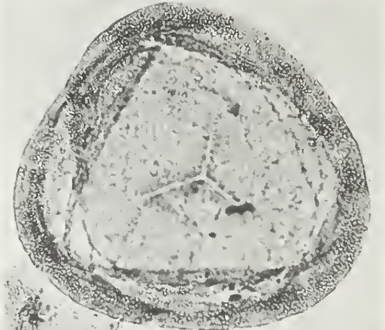
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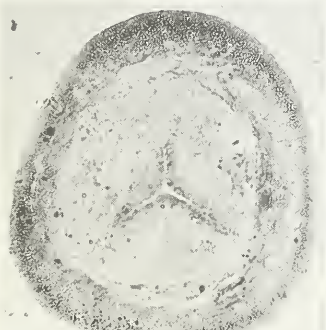
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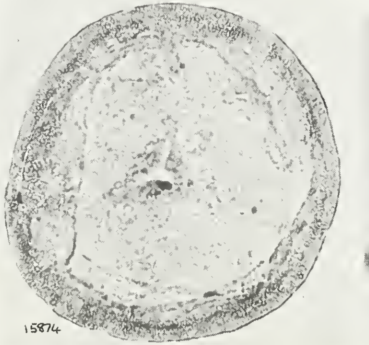
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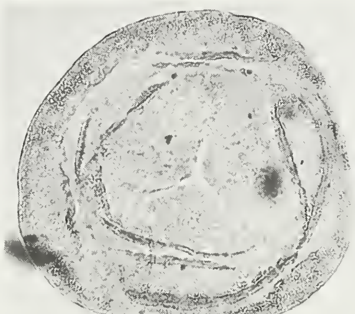
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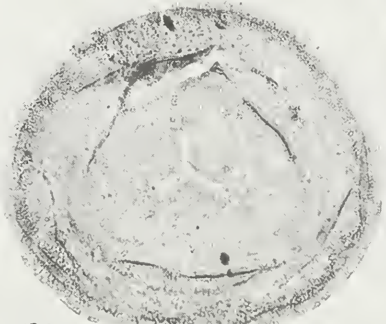
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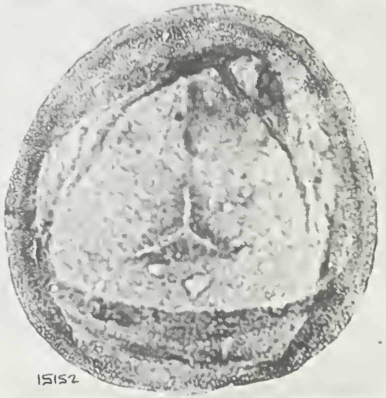
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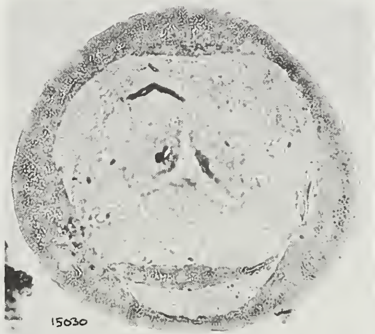
Vestigisporites rotatus (Balme & Henn. '56) comb. nov.

● HKr.



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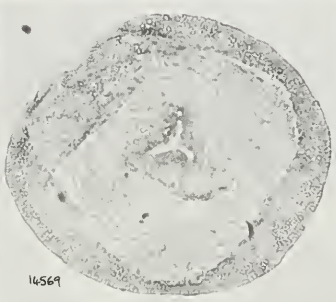

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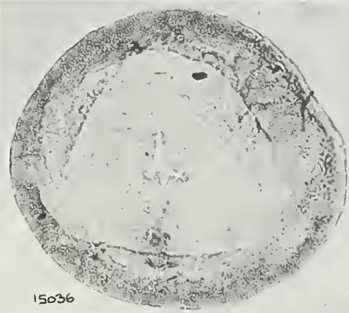

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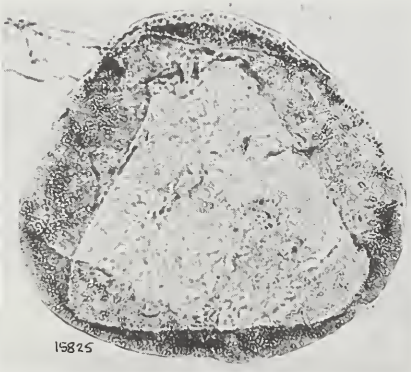

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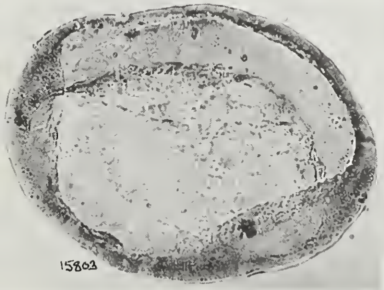

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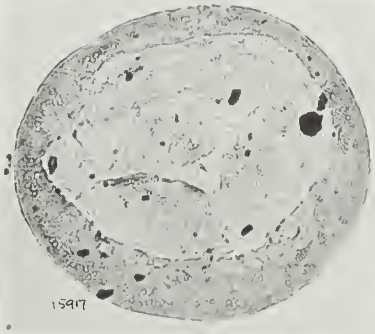

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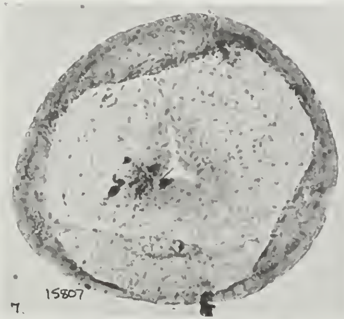

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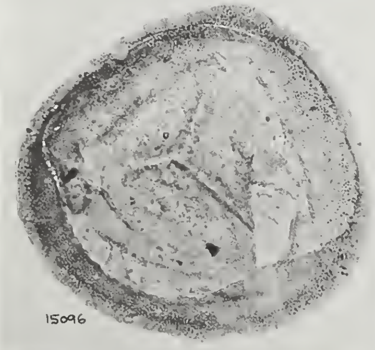

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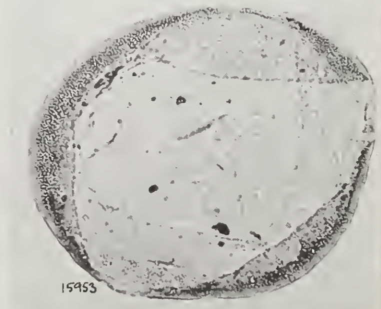

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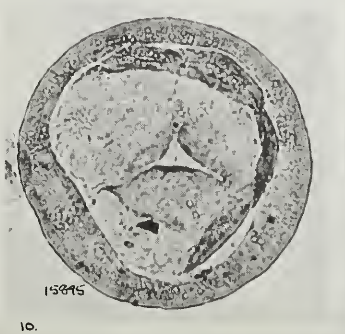

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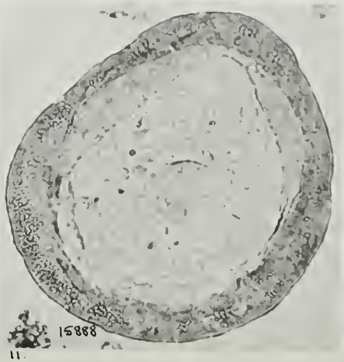

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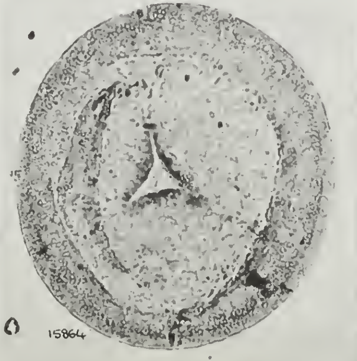

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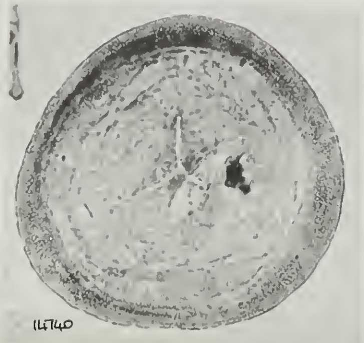

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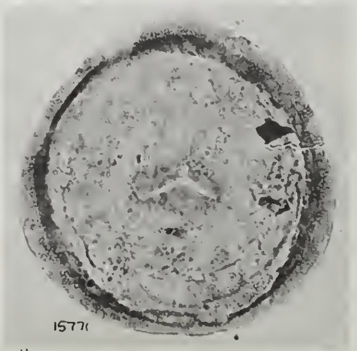
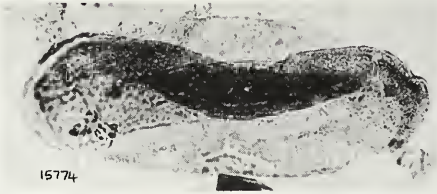


14.

Vestigisporites rotatus (Balme + Henn.'56) comb.nov.

● HKr.



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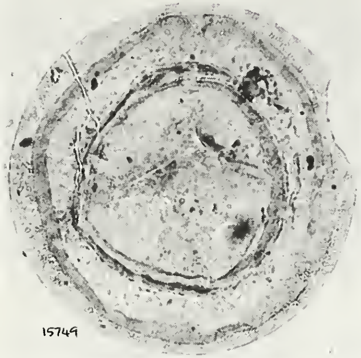

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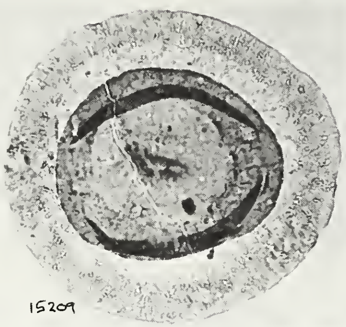

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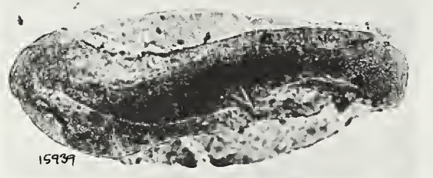

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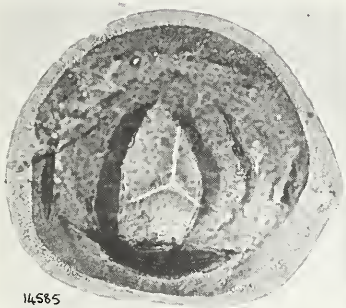

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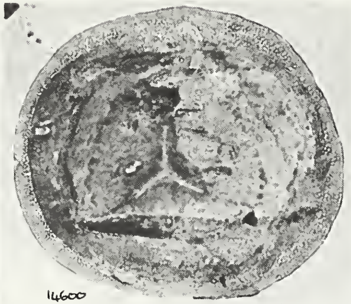

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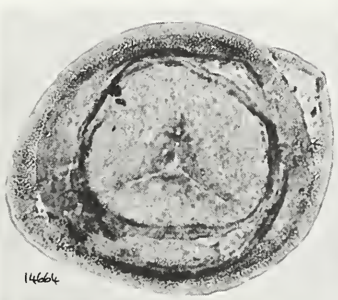

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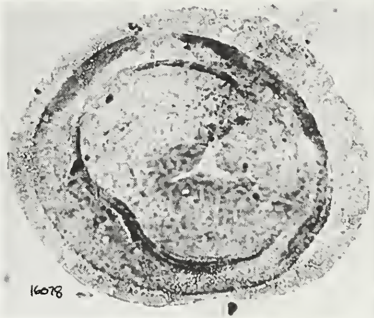

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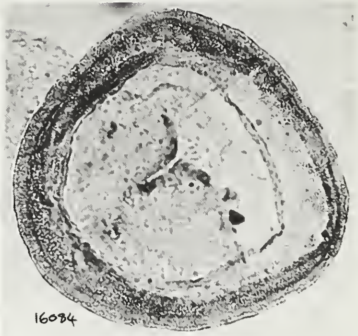

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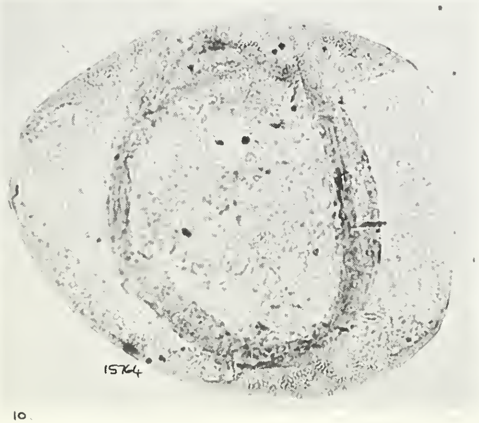

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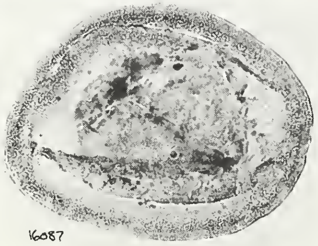

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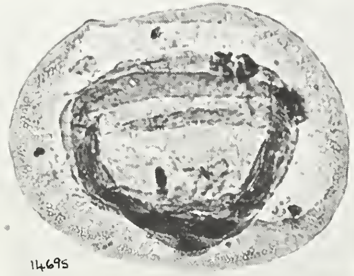

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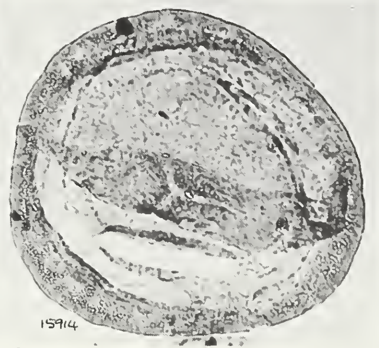
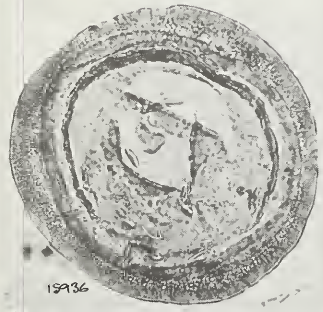


13.

Vestigisporites rotatus (Balme & Henn.'56) comb. nov.

● HKr.



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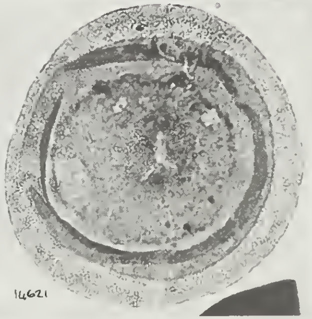

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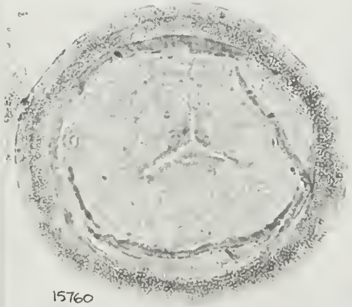

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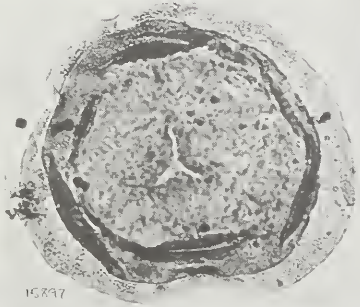

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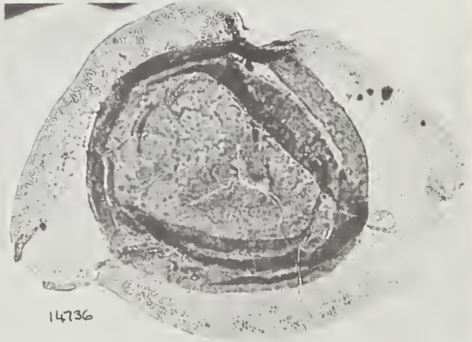

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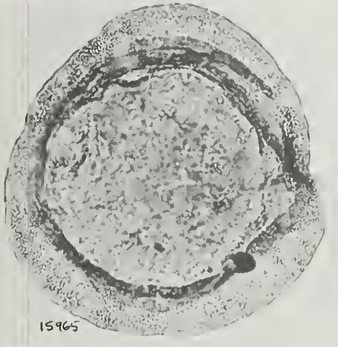

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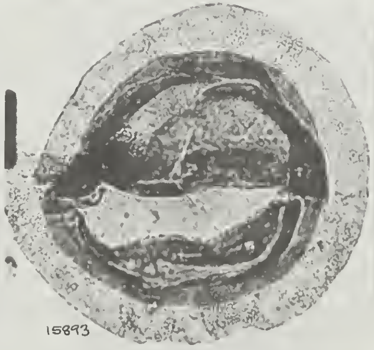

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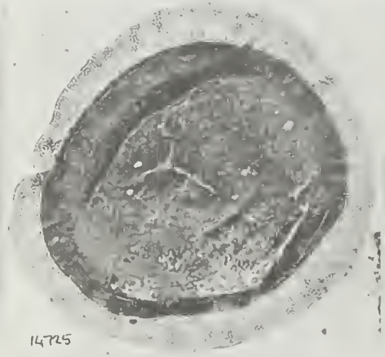

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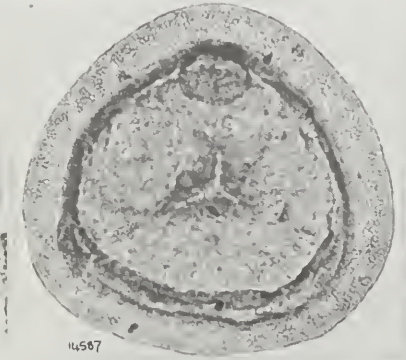

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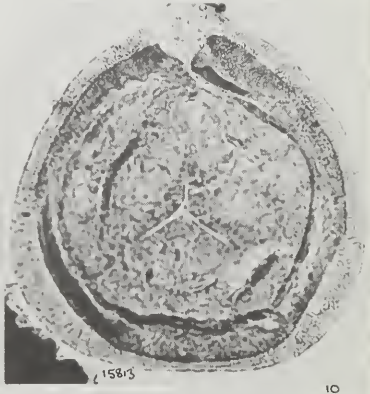

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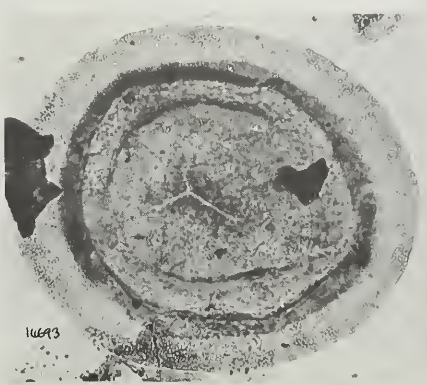

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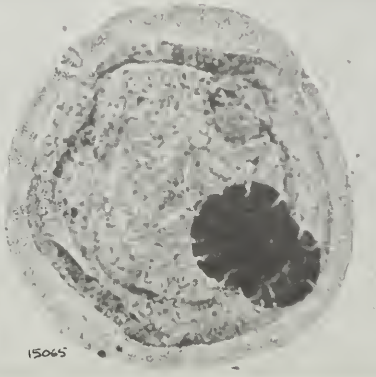

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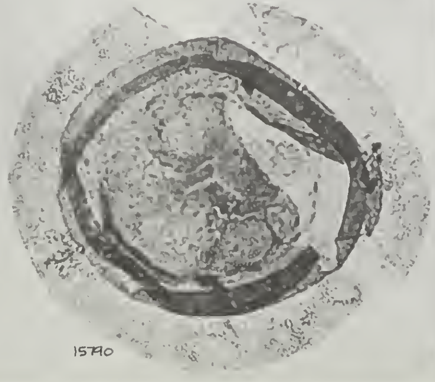

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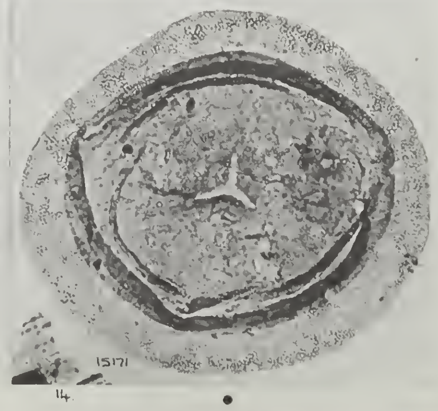
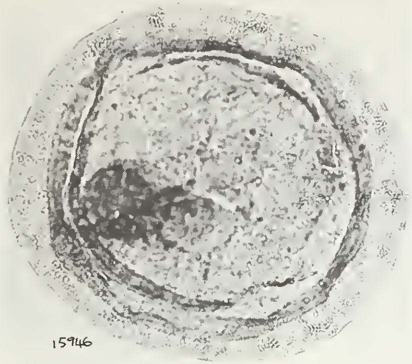


14.

Vestigisporites rotatus (Balme & Henn. '56) comb. nov.
● HKr



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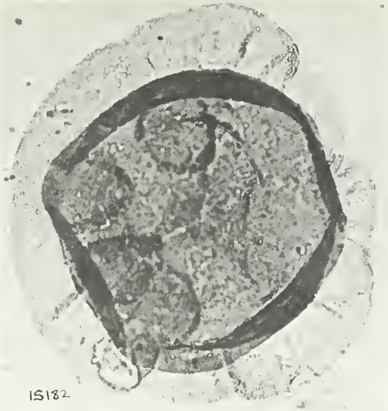

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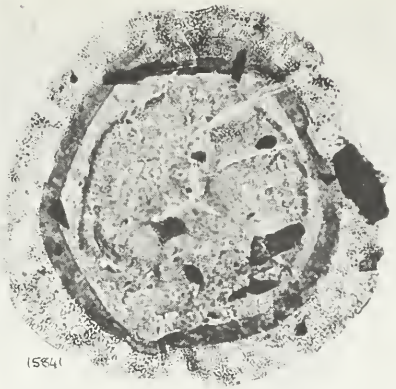

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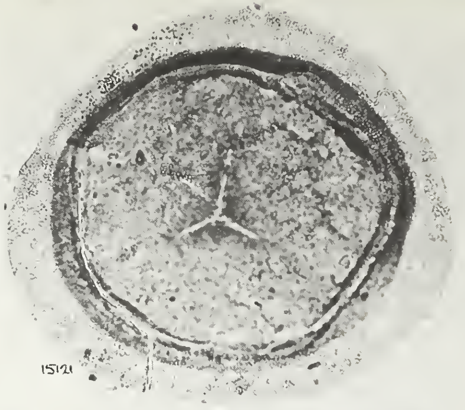

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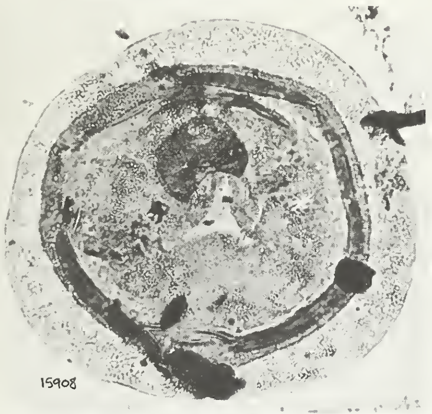

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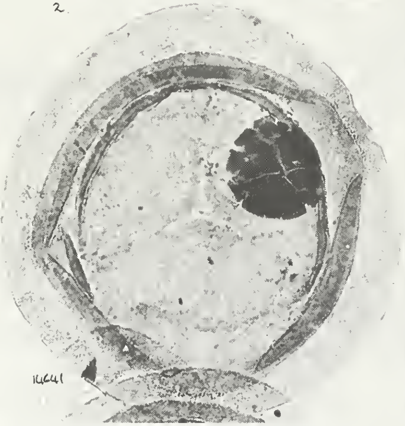

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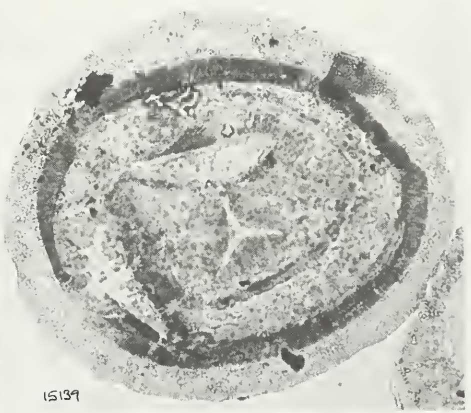

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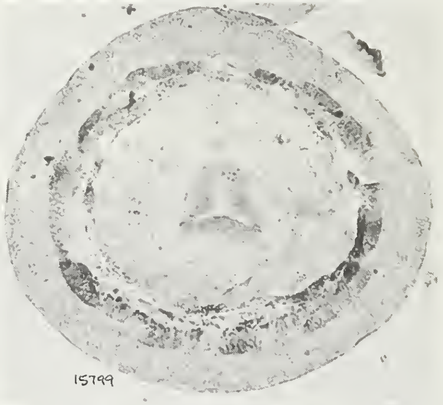

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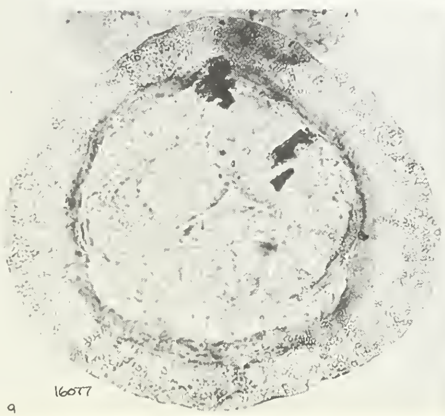

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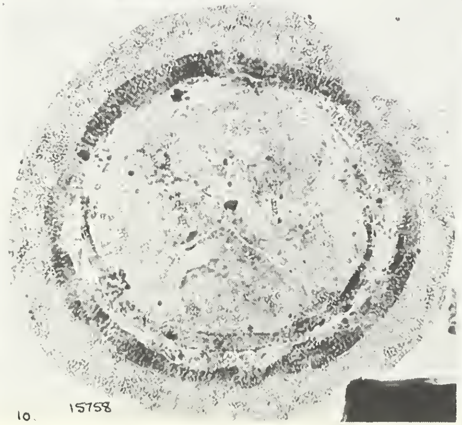

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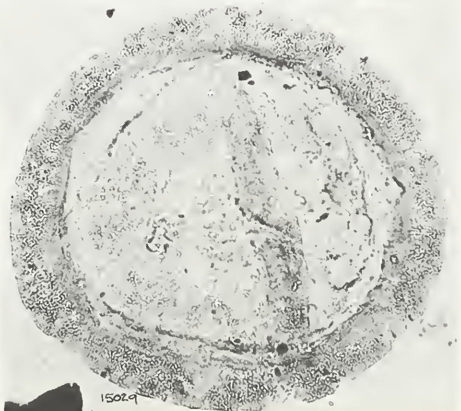

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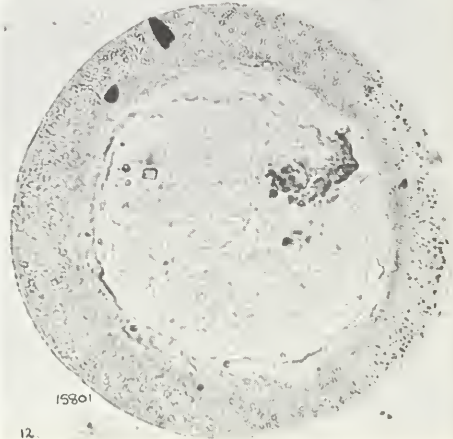
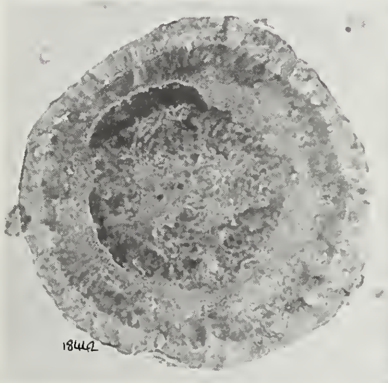


12.

Vestigisporites rotatus (Balme & Henn. '56) comb. nov.

○ OW 1145'



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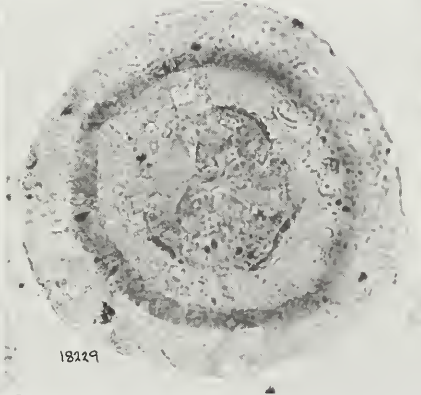

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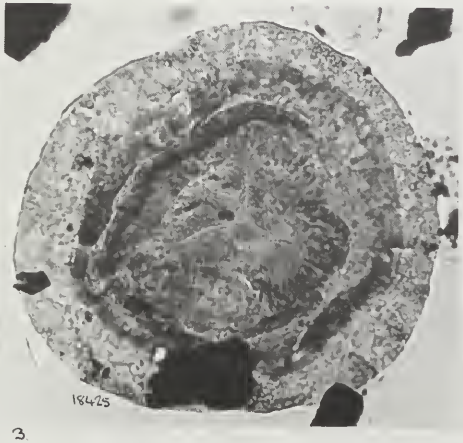

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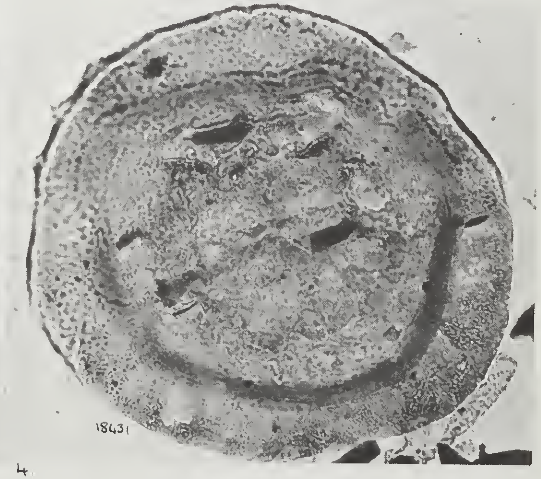
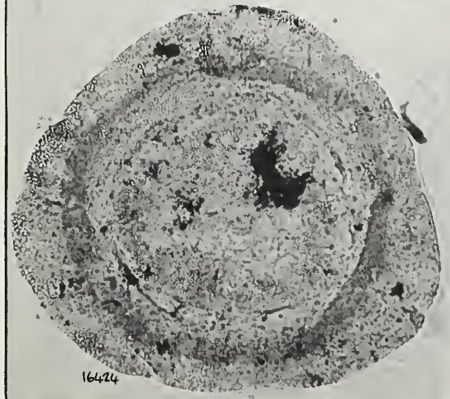


4.

○ UC 678 80,6



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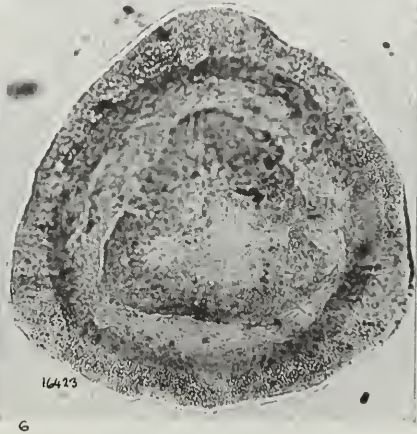

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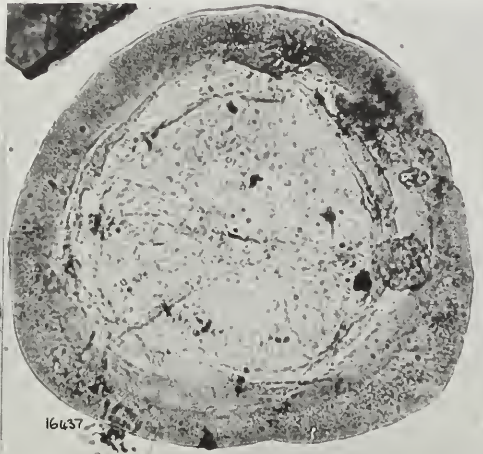

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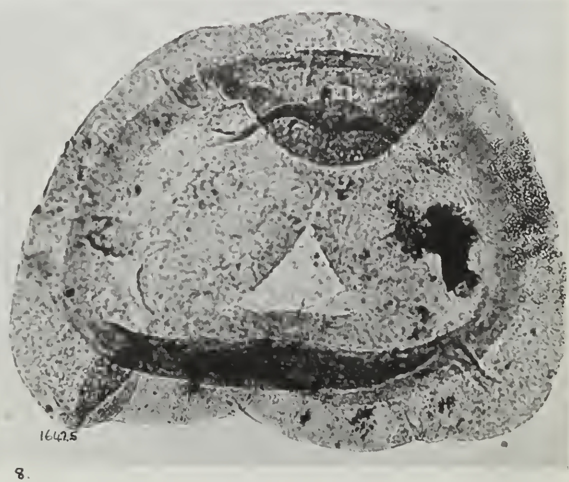
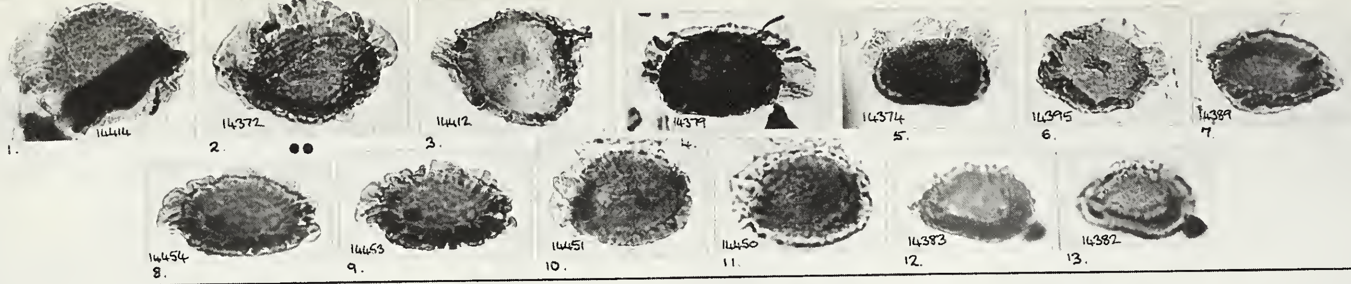


8.

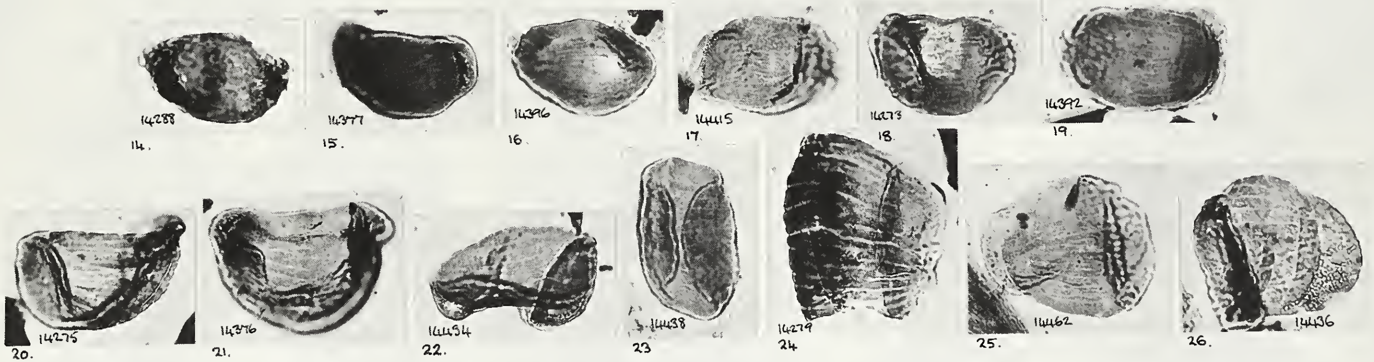
Vittatina circumsaccata sp.nov.

● SAP 6 1131'

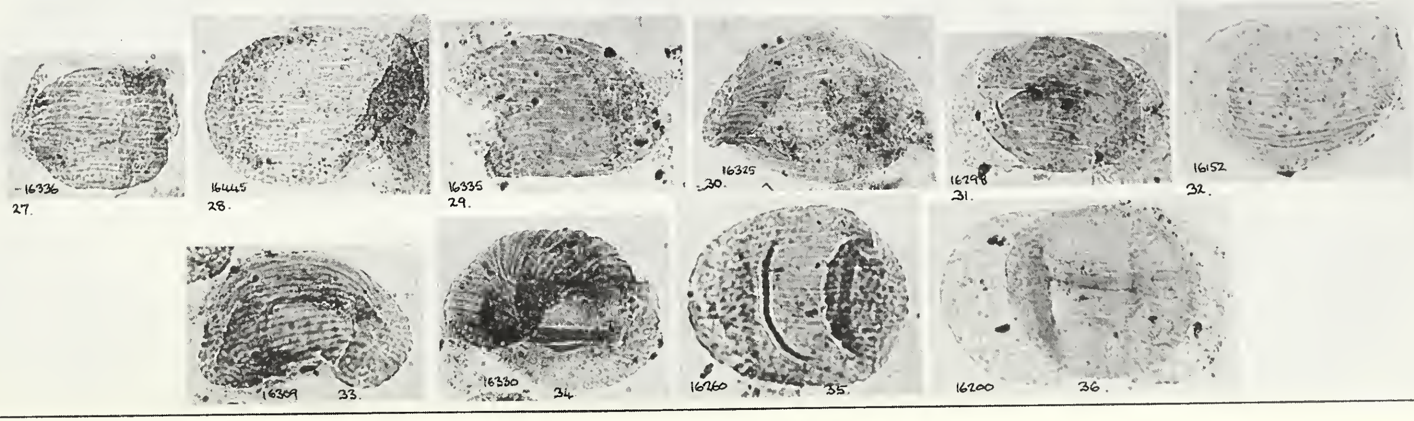


Vittatina multistriata (Balme+Henn.'55) comb.nov.

○ SAP 6 1131'

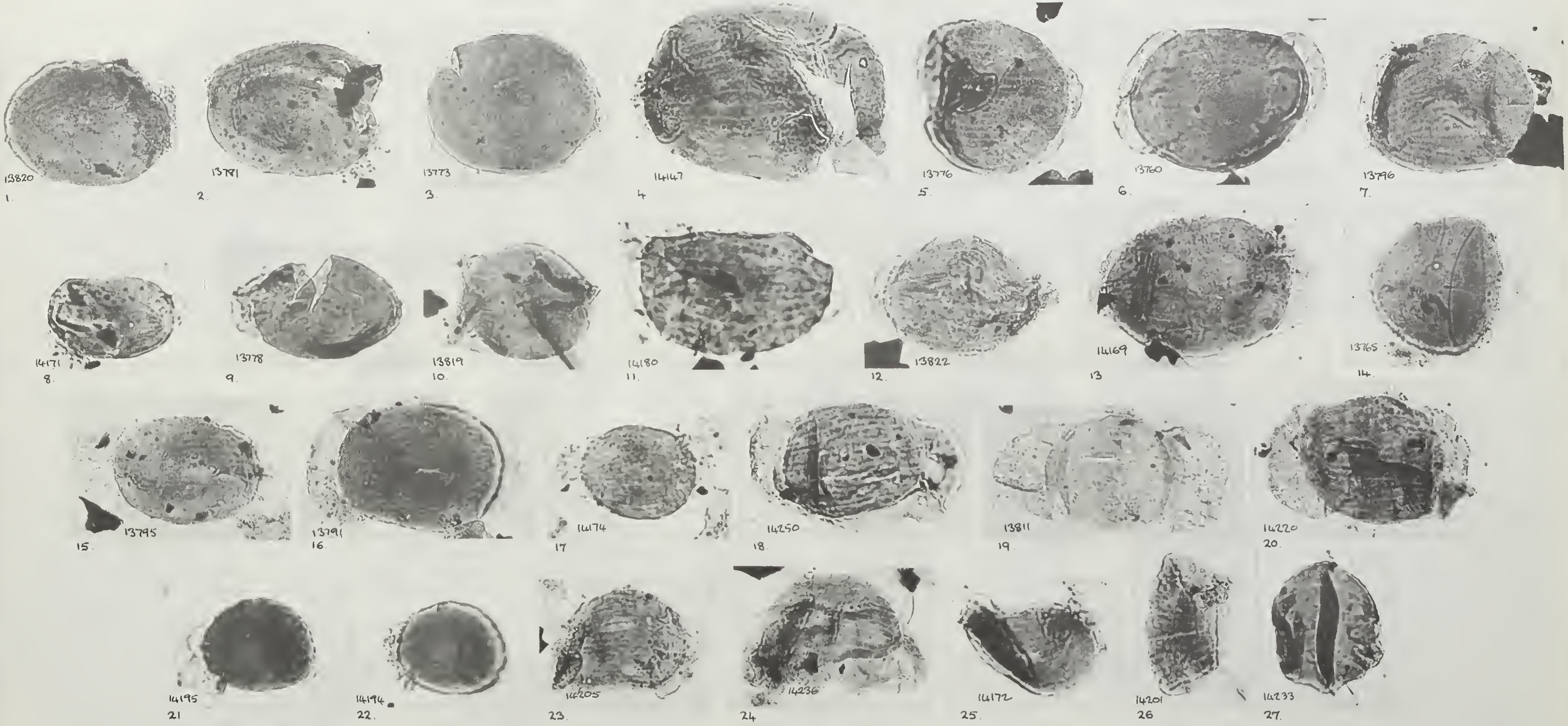


○ UC 678 79,0 , 80,6



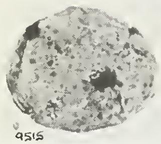
Vittatina multistriata (Balme & Henn.'55) comb.nov.

o SAP 6 1151'3", 1152'3", 1152'9"



Vittatina multistriata (Balme & Henn.'55) comb. nov.

o SAP 6 1000', 1007', 1007'6", 1017', 1019'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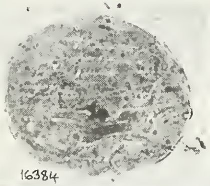
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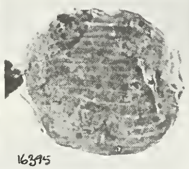
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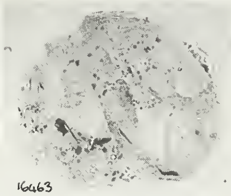
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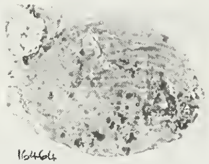
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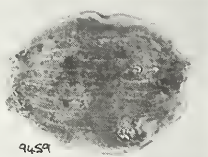
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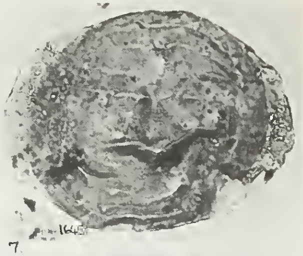
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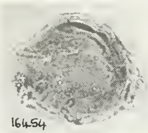
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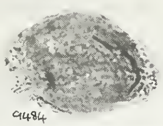
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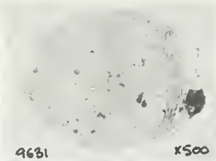
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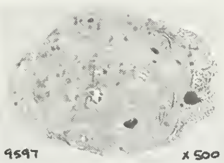
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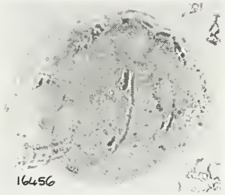
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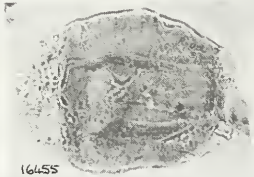
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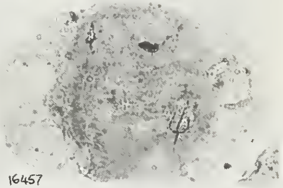
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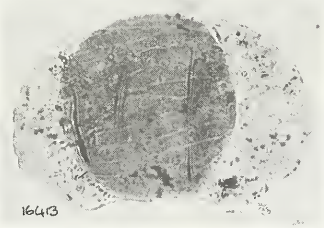
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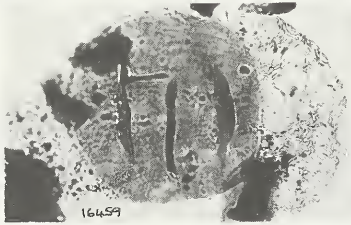
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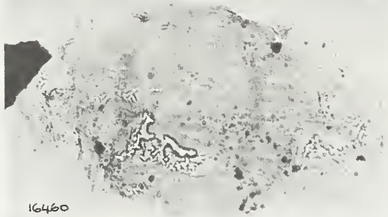
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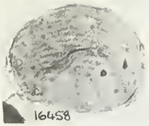
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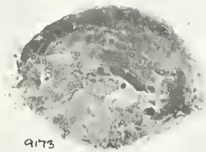
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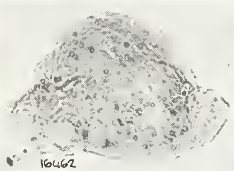
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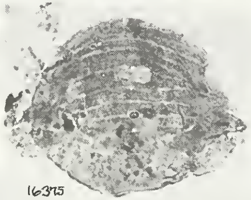
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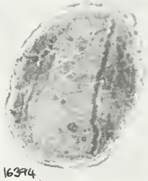
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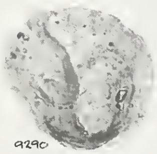
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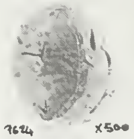
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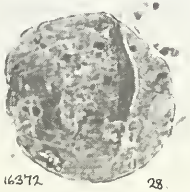
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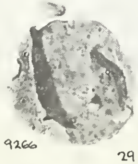
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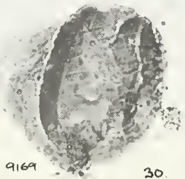
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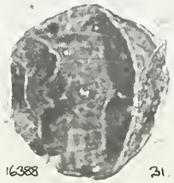
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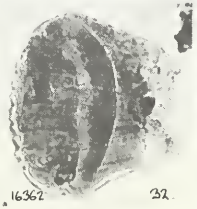
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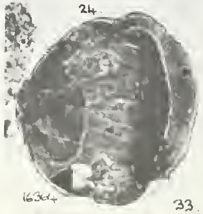
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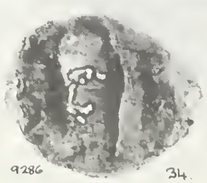
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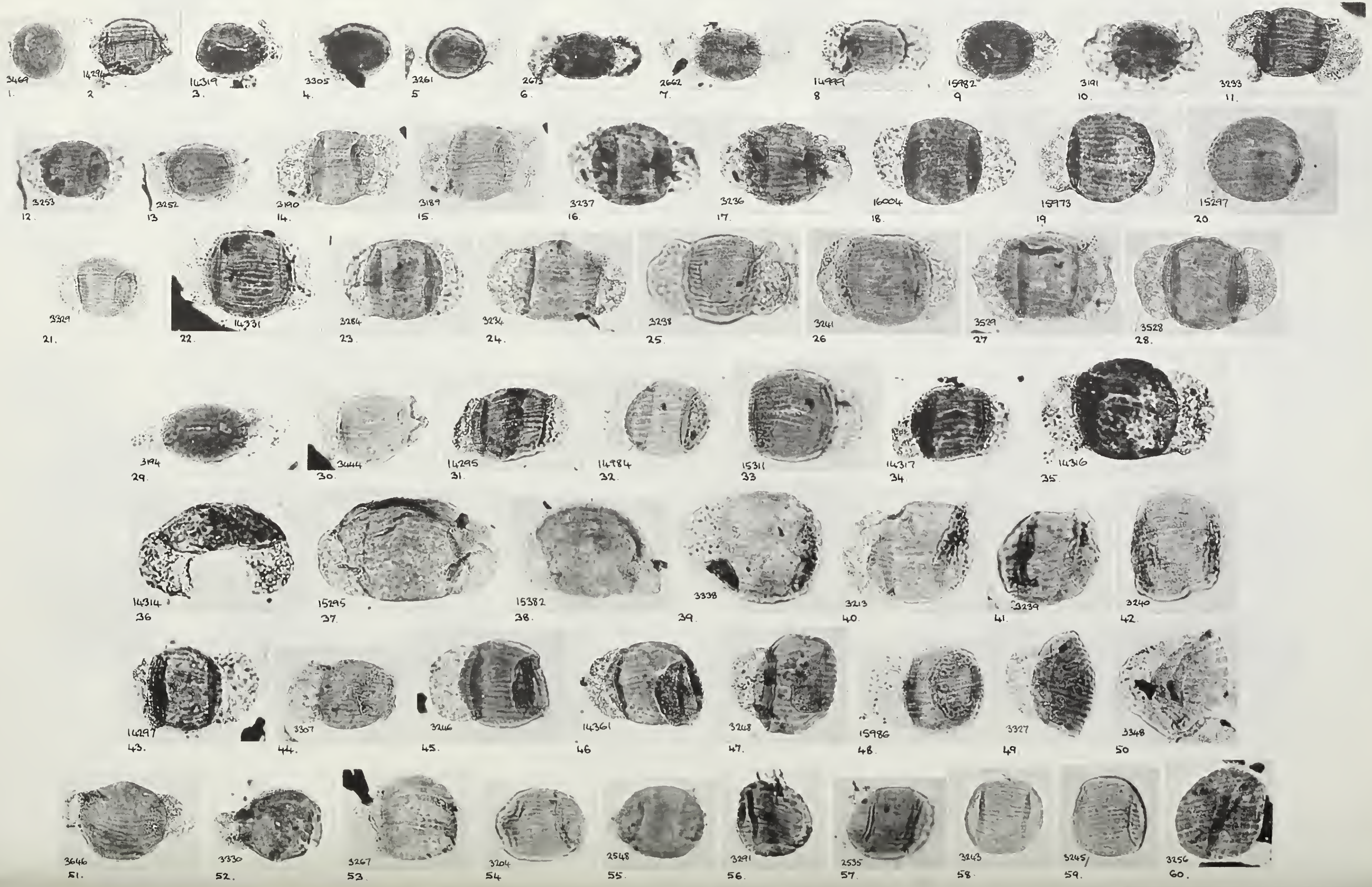
Vittatina multistriata (Balme + Henn.'55) comb. nov.

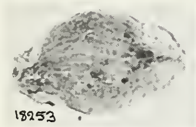
o HKr.



Vittatina multistriata (Balme & Henn.'55) comb. nov. / Vittatina nonsaccata sp. nov.

pl. 125 (1-30), pl. 126 (1-11) — pl. 126 (12-23)

: OW 1145'



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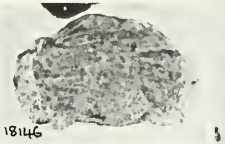

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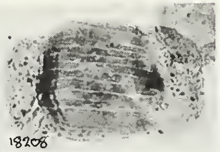

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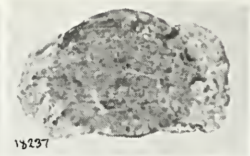

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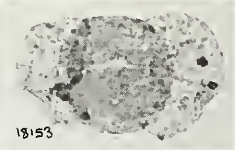

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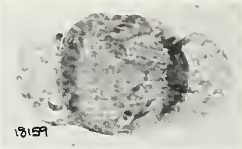

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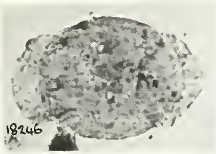

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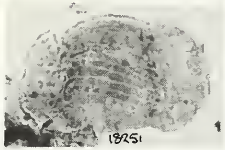

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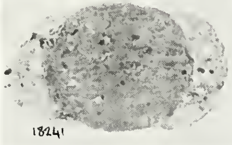

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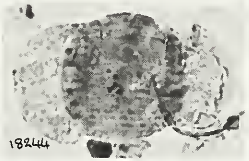

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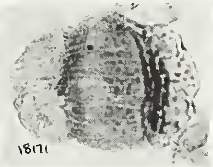

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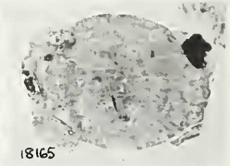

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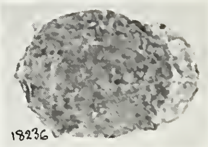

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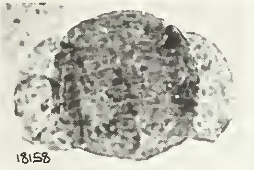

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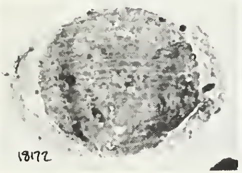

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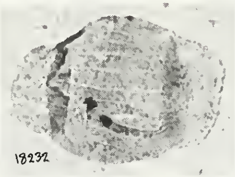

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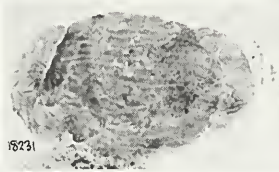

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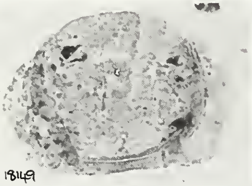

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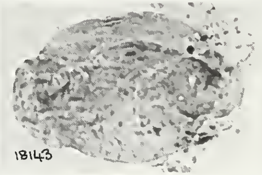

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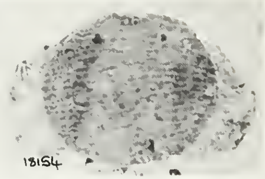

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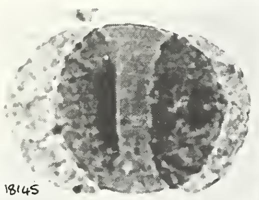

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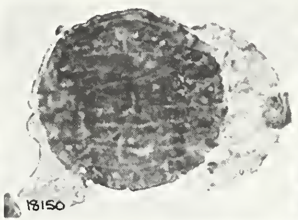

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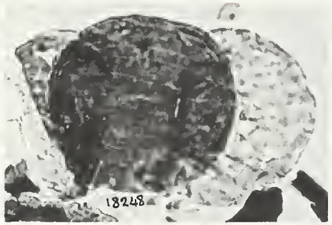

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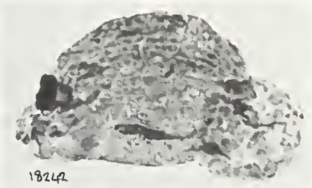

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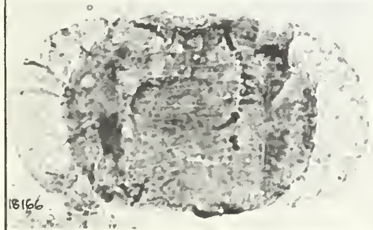

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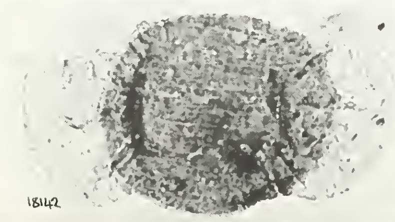

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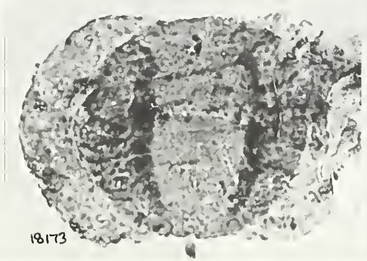

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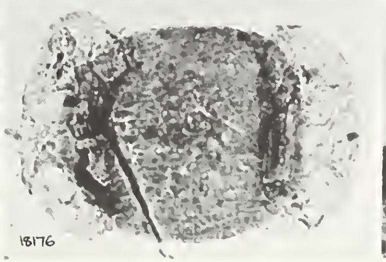

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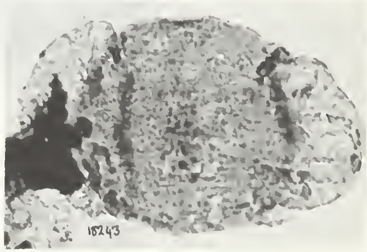
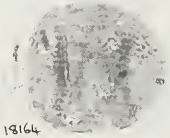


30.

Vittatina multistriata (Balme+Henn.'55) comb. nov. / Vittatina nonsaccata sp. nov.

pl. 125 (1-30), pl. 126 (1-11) pl. 126 (12-23)

● OW 1145'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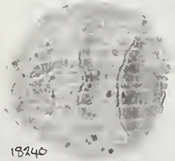
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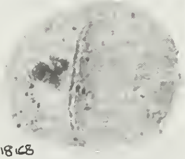
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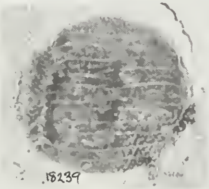
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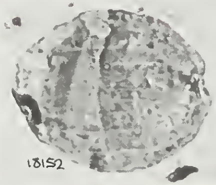
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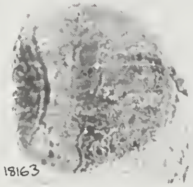
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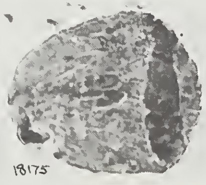
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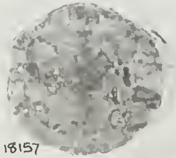
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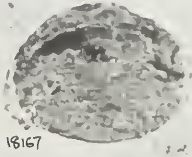
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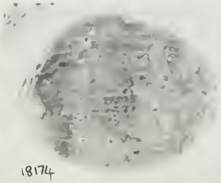
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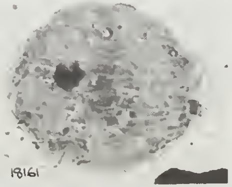
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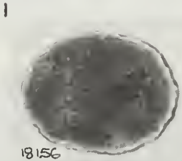
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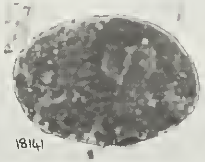
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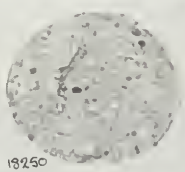
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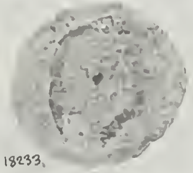
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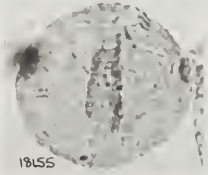
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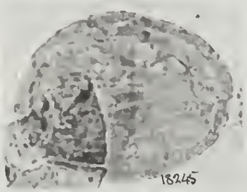
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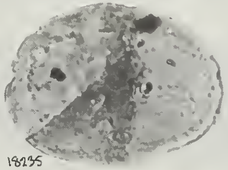
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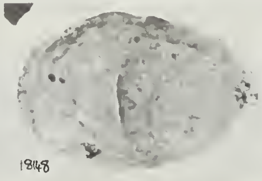
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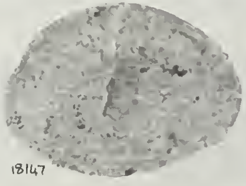
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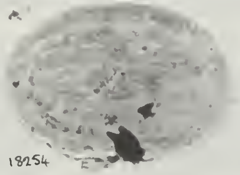
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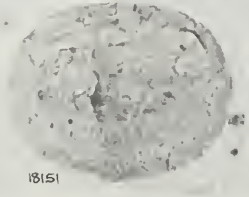
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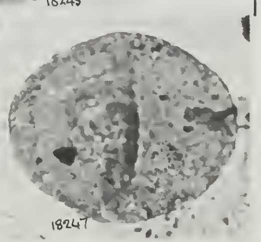
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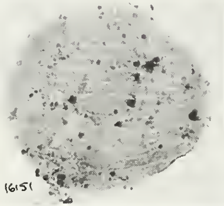
23.

Vittatina nonsaccata sp. nov.

o UC 678 79,0 , 80,6



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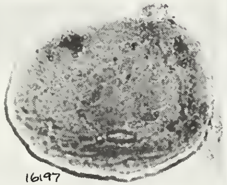

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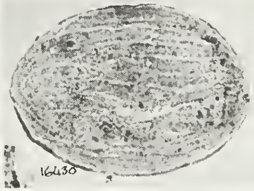

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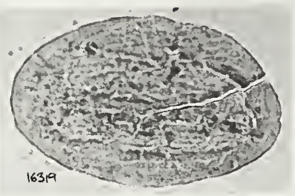

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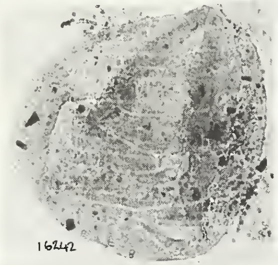

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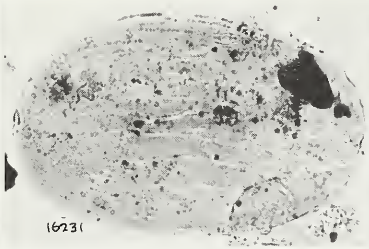

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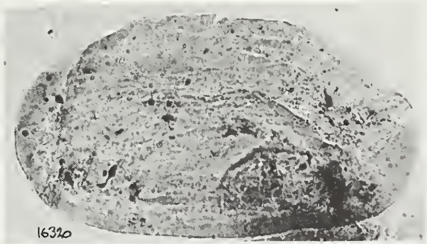

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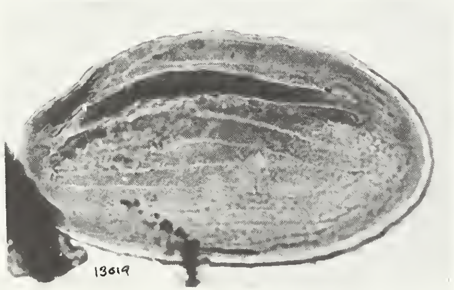
o WV3 133,50



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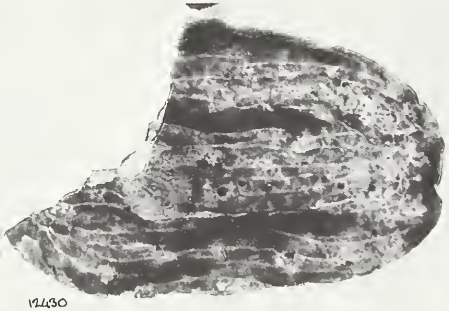
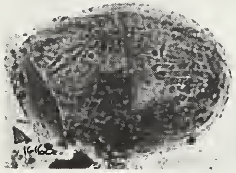
o UC 678 31,6



9.

Vittatina simplex (Tiw.'65) comb.nov.

● UC 678 79,0



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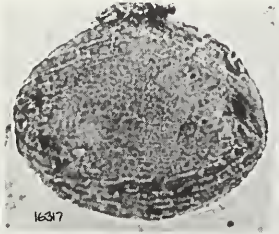

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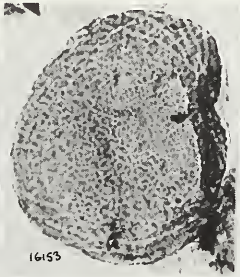

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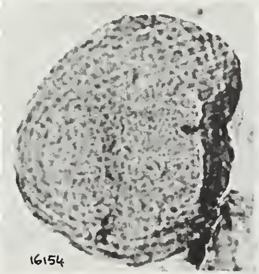

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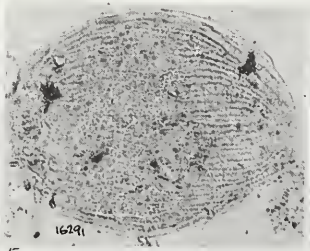

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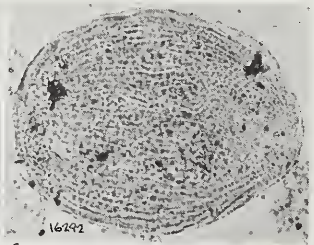

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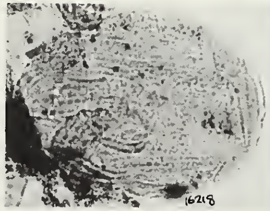

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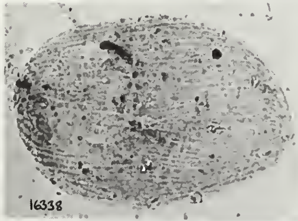

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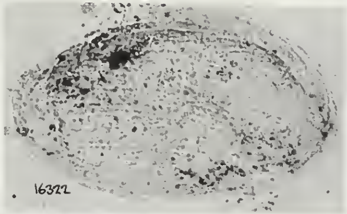

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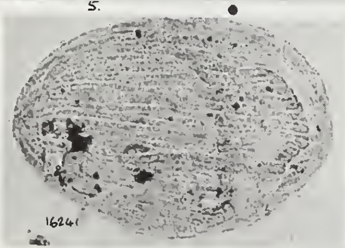

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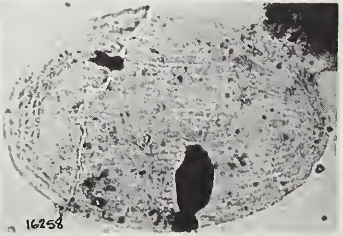

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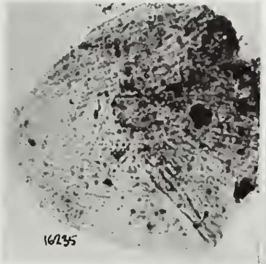

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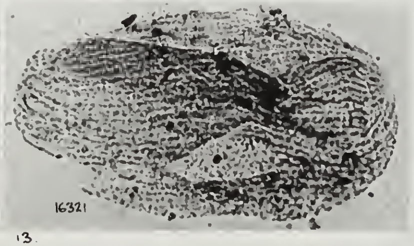
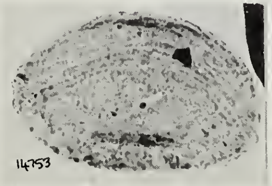


13.

○ HKr.

○ OW 1145'



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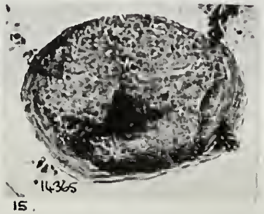

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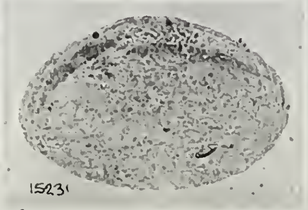

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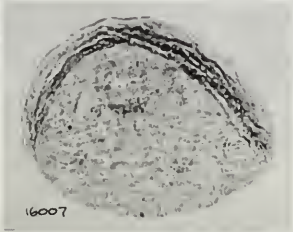

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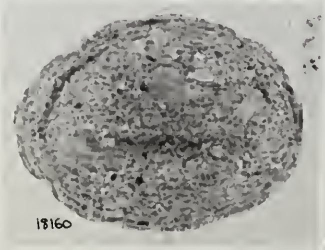

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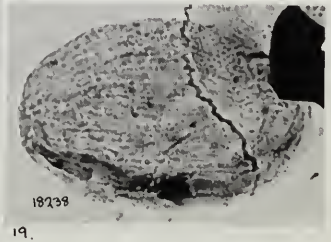
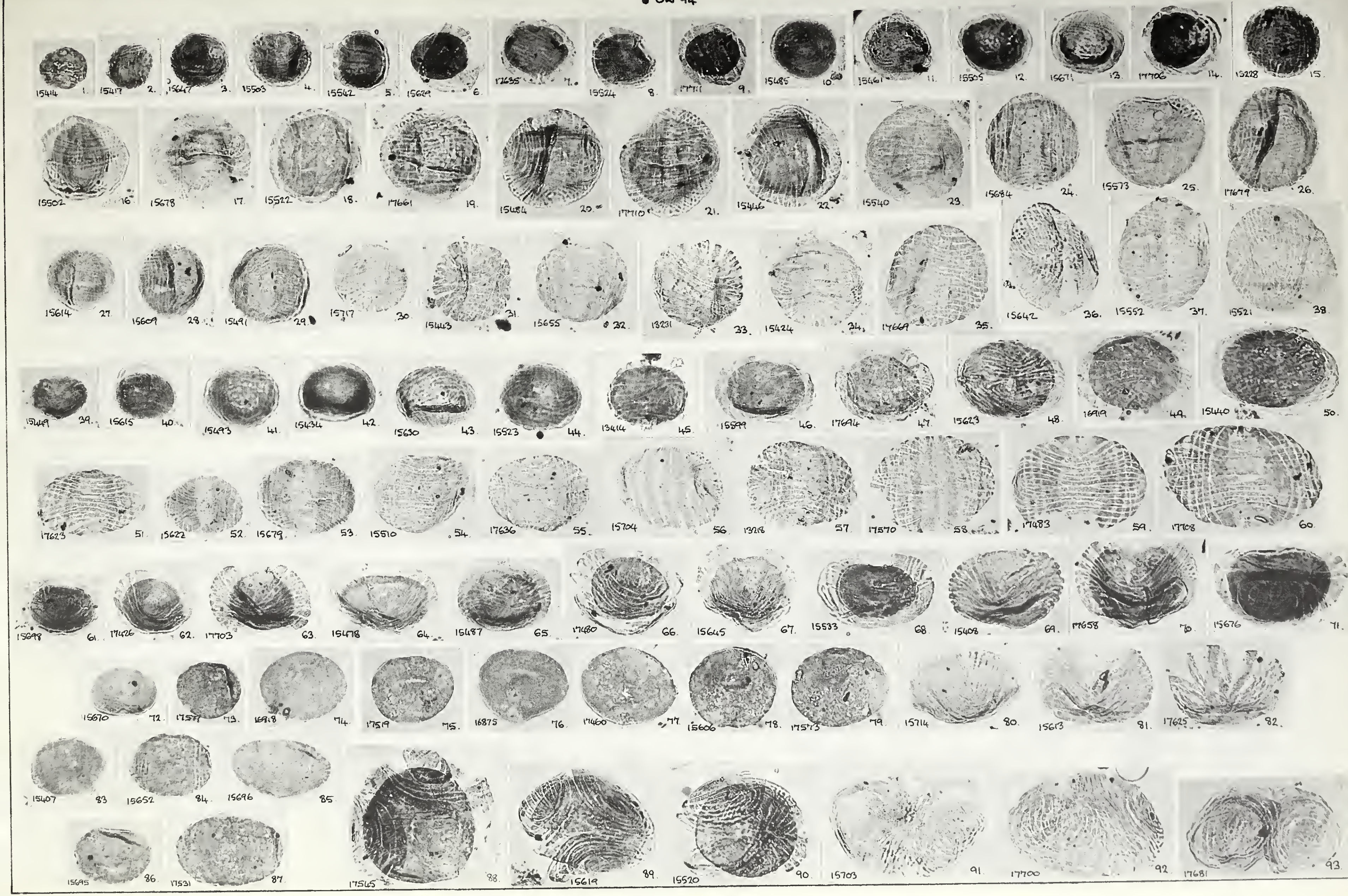


19.

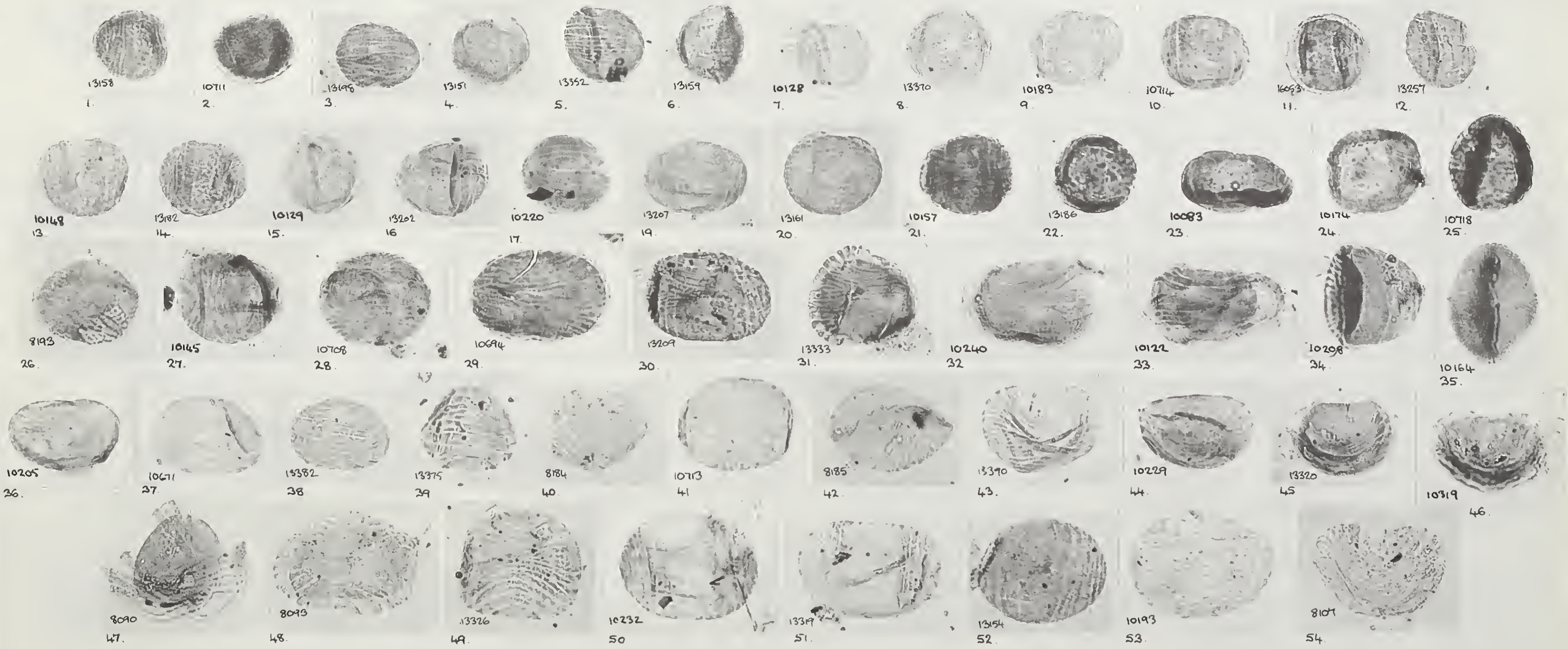
Vittatina lucifera (Bharad. + Sal.'64) comb.nov.

● OW 94'



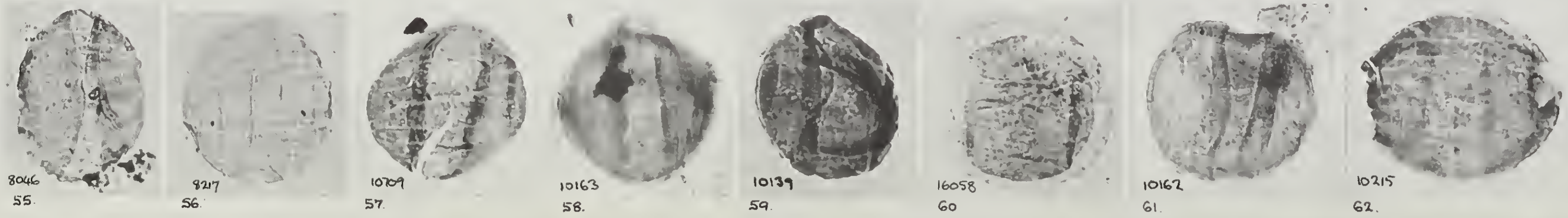
Vittatina lucifera (Bharad. & Sal. '64) comb. nov.

o Kb.



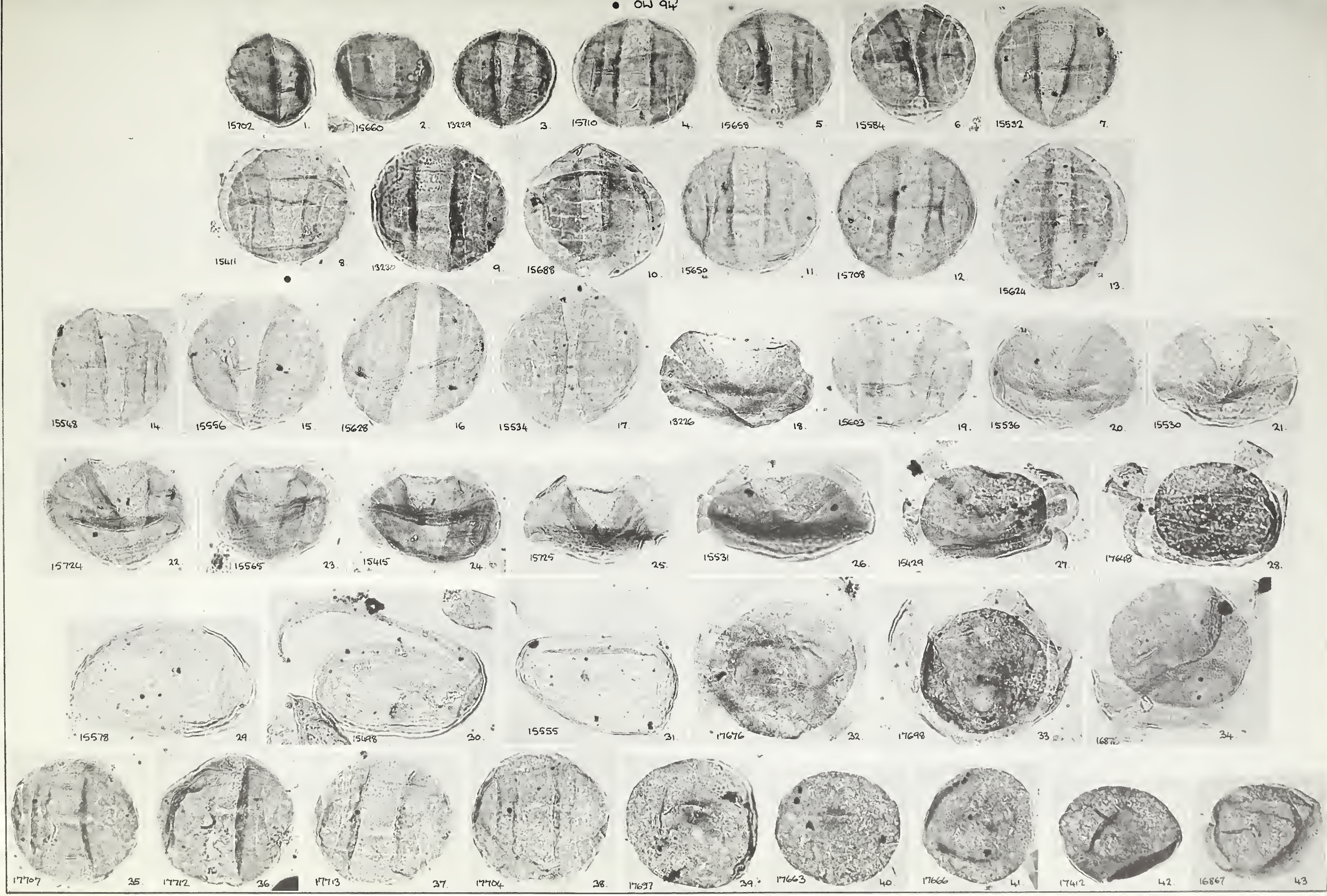
Vittatina magma (Bose & Kar '66) comb. nov.

o Kb.



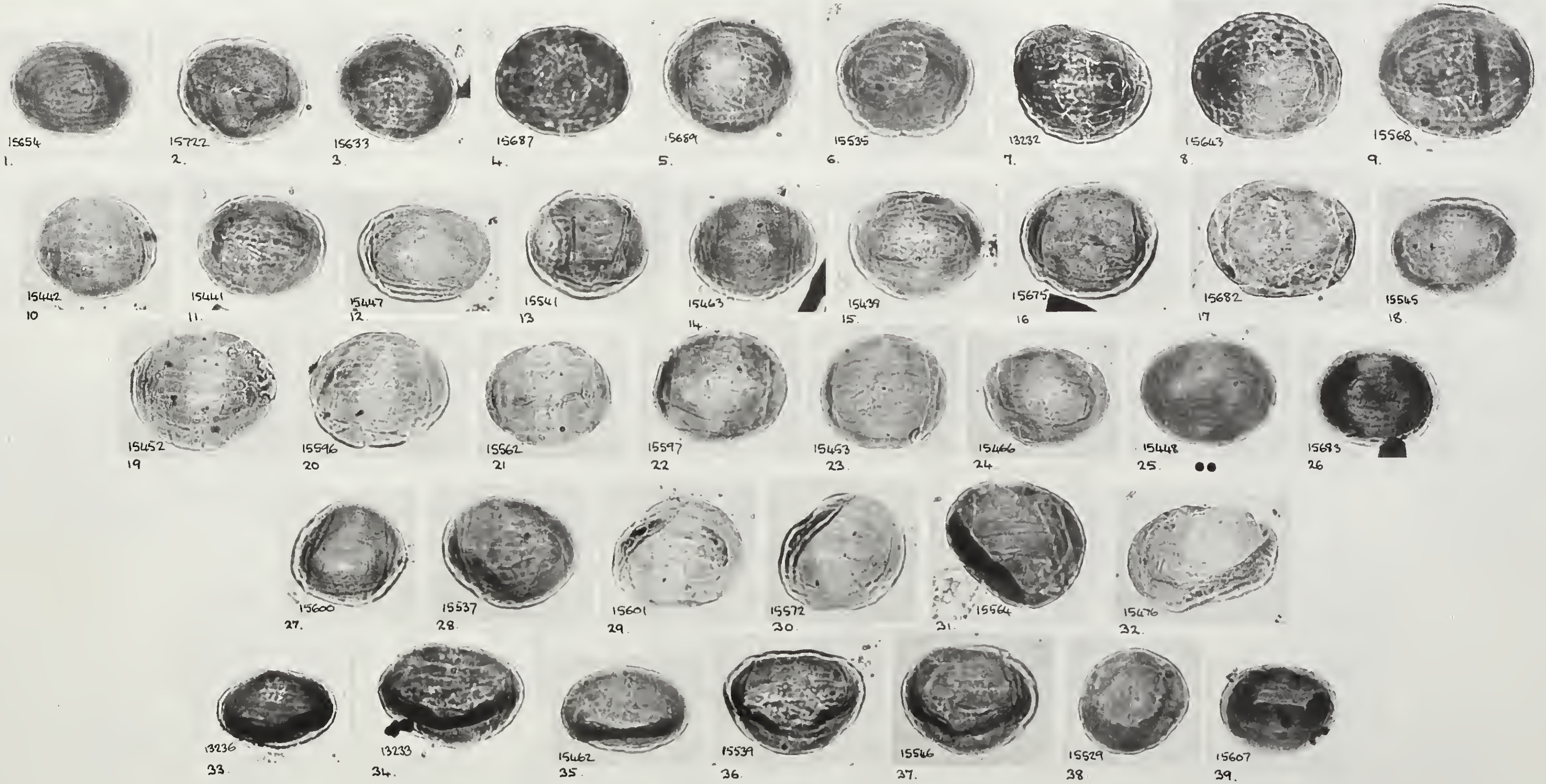
Vittatina magma (Bose + Kar '66) comb. nov.

● OW 94'



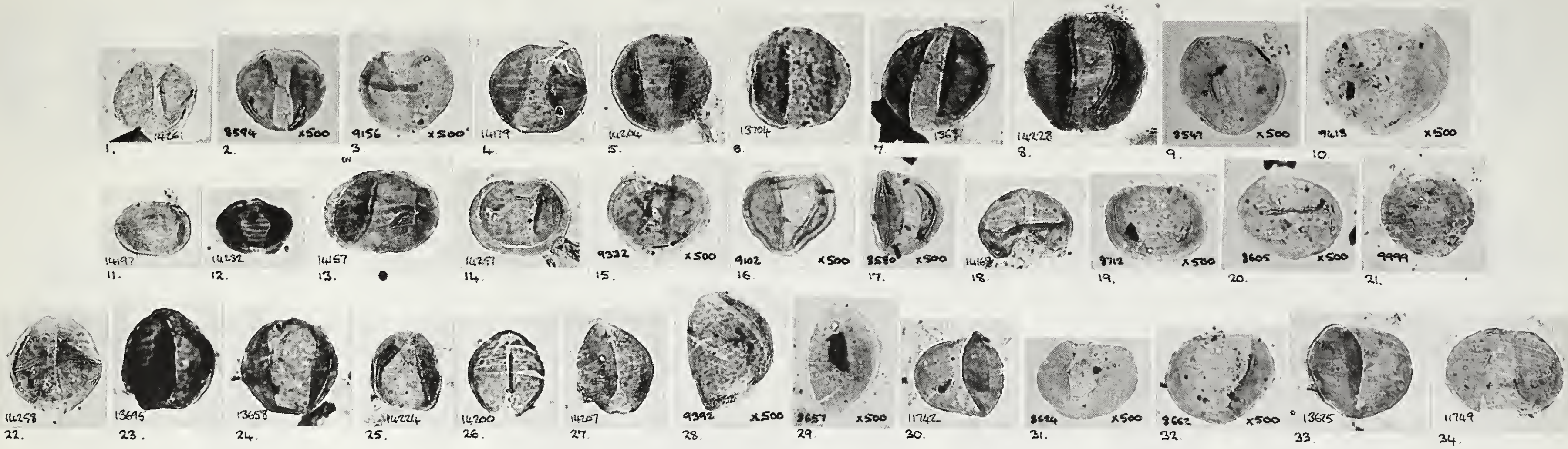
Vittatina densa sp. nov.

● OW 94'

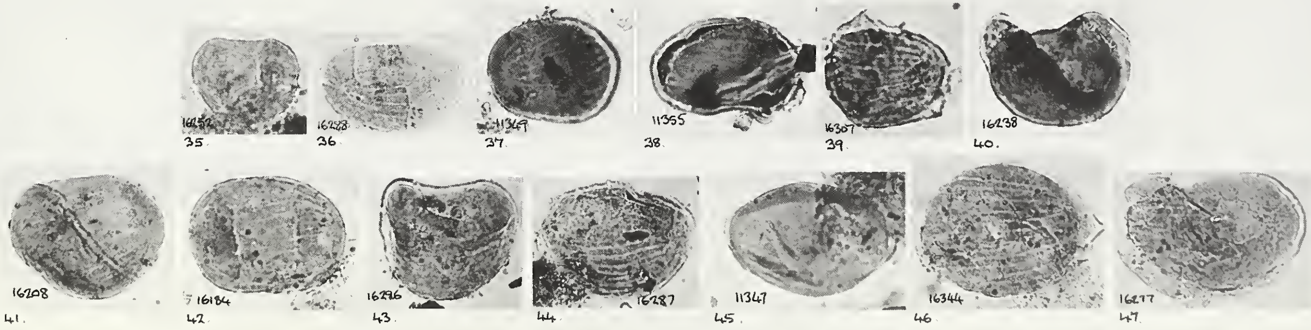


Vittatina fasciolata (Balme & Henn.'56) comb. nov.

● SAP 6 1151'3", 1152'3", 1152'9"

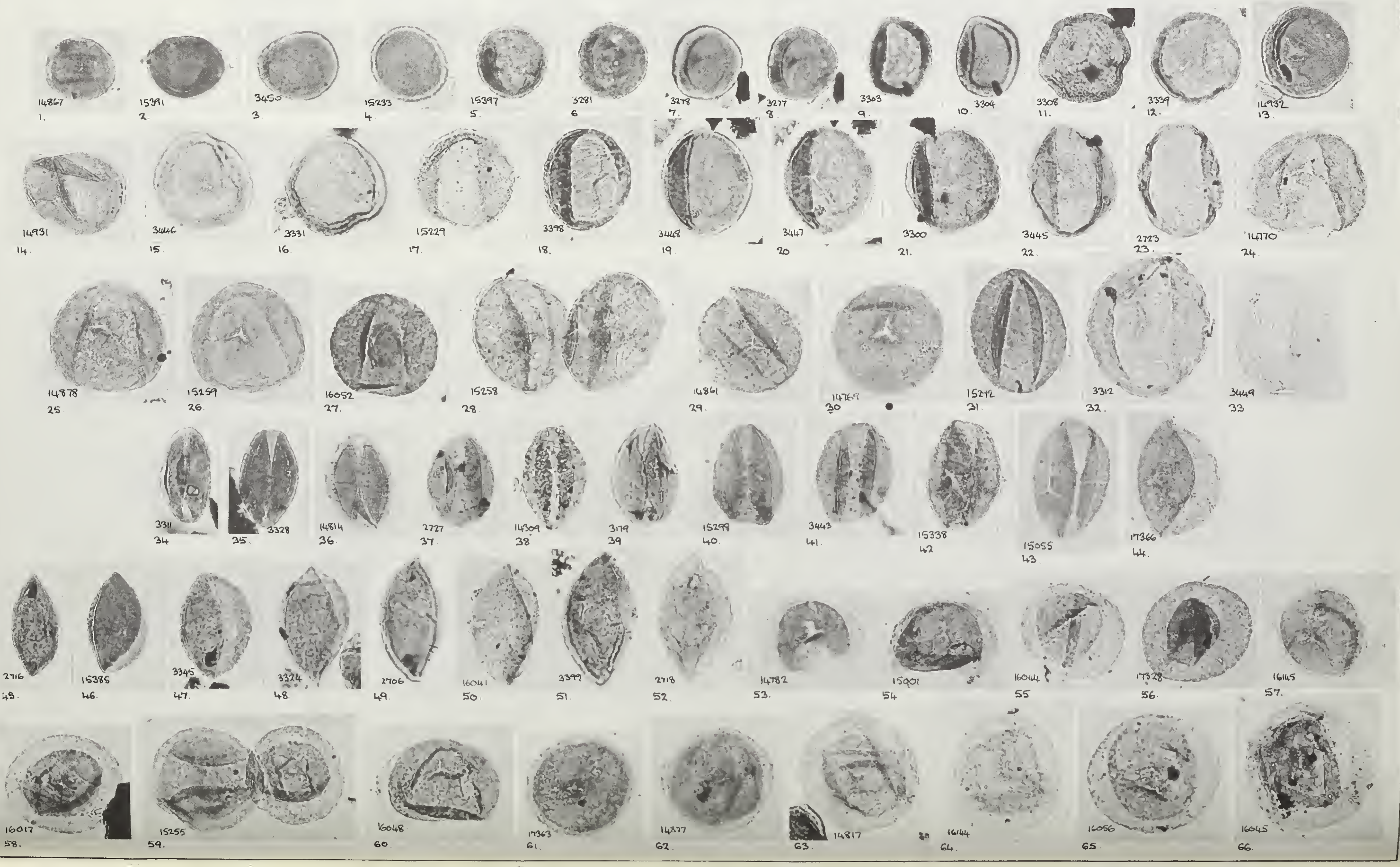


○ UC 678 79,0 , 79,3



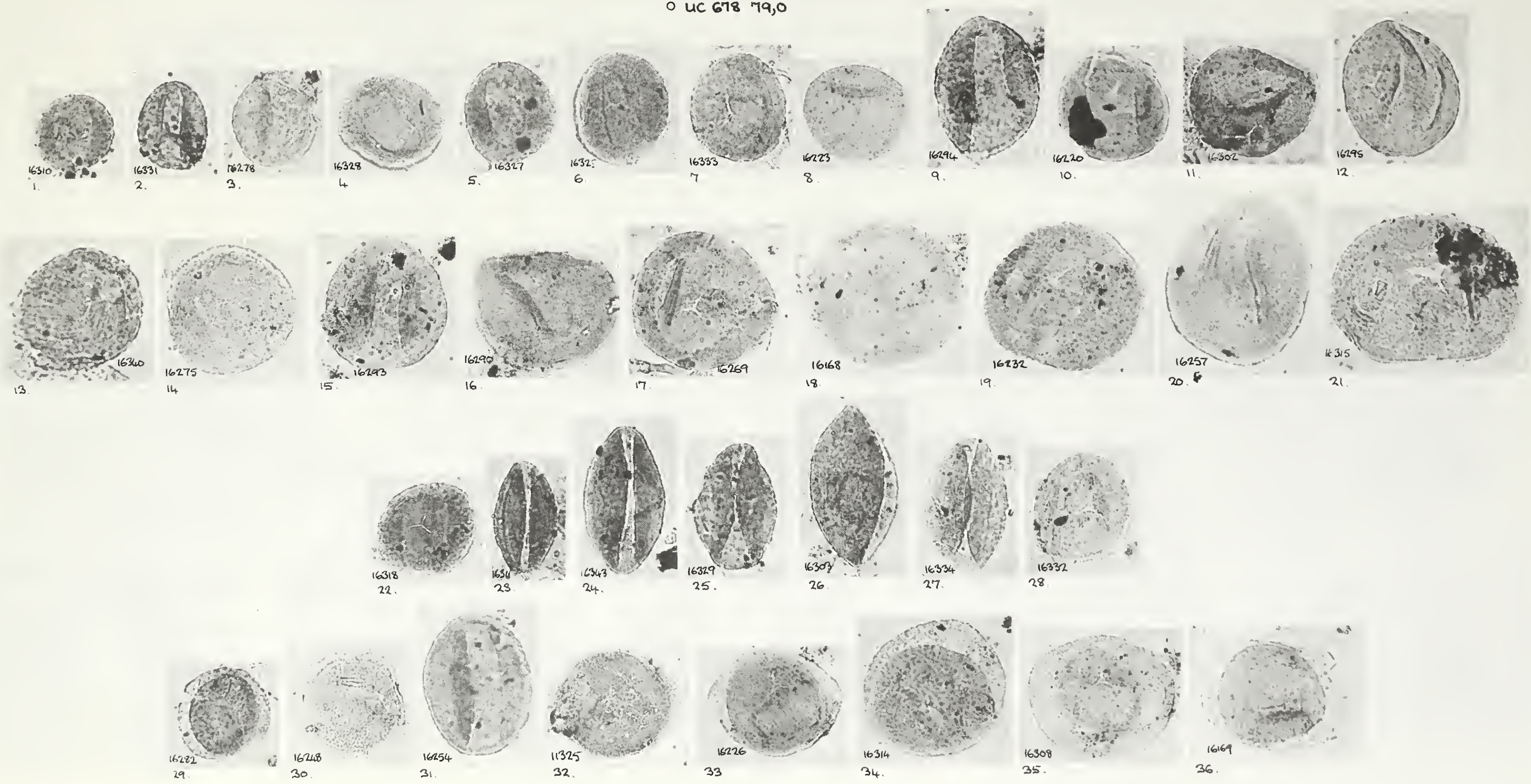
Vittatina triradiata (Balme + Henn.'56) comb.nov.

● HKr.



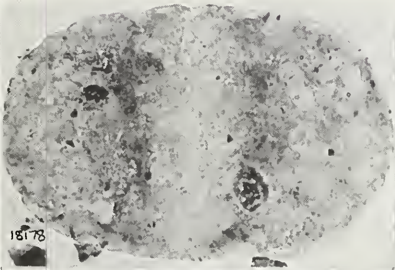
Vittatina triradiata (Balme & Henn.'56) comb. nov.

o UC 678 79,0



Pityosporites nectus (Venk.+Kar '68) comb.nov.

0 OW 1145'



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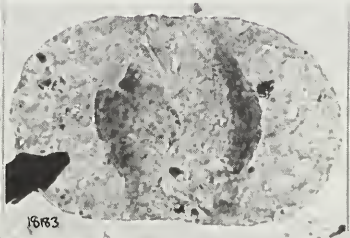

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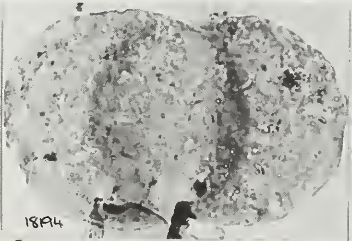

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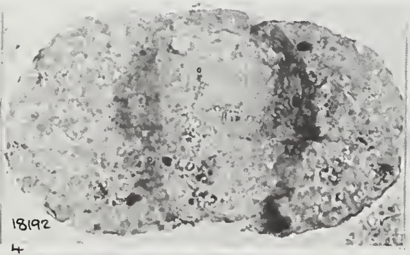

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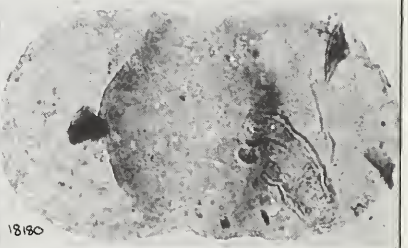

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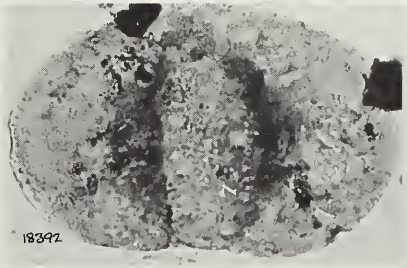

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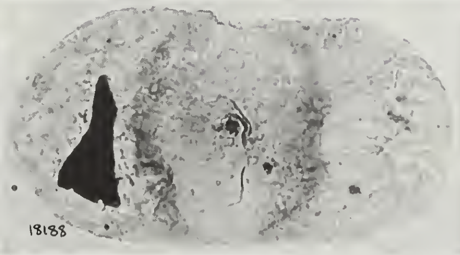

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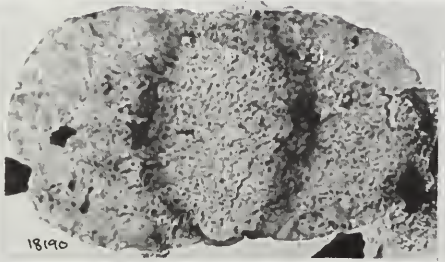

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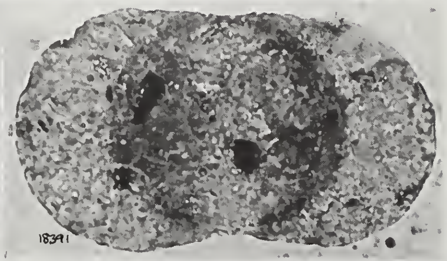
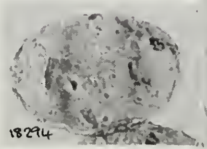


9.

Pityosporites triassicus (Bharad.+Sriv.'69) comb.nov.

0 OW 1145'



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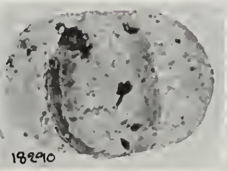

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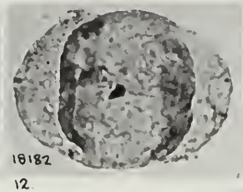

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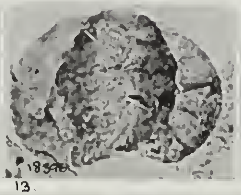

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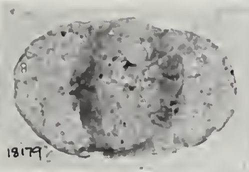

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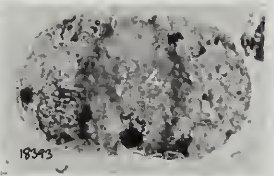

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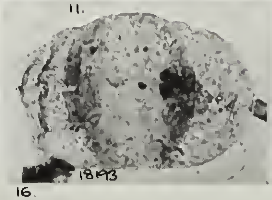

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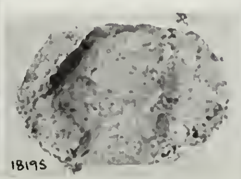

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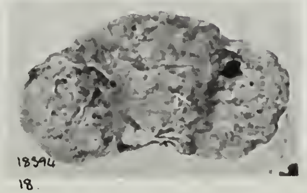

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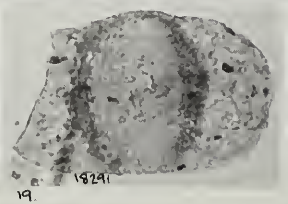
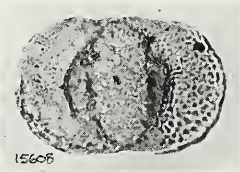


19.

Pityosporites triassicus (Bharad. + Sriv. '69) comb. nov. / P. nucleoparvus sp.nov.
pl. 137 (in full) pl. 138 (in full)

OW 94'



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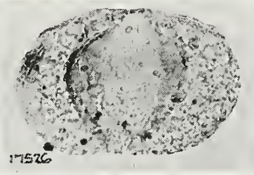

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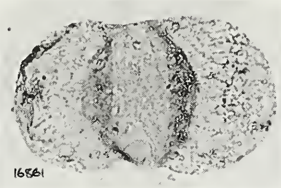

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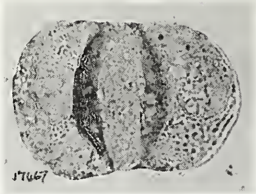

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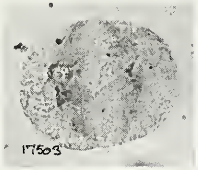

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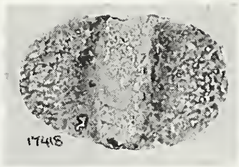

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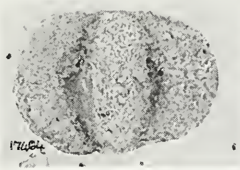

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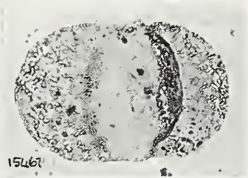

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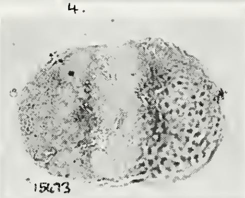

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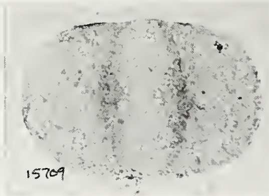

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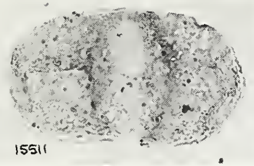

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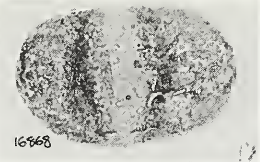

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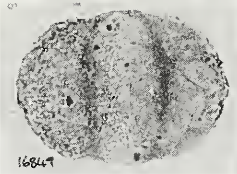

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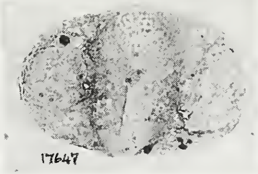

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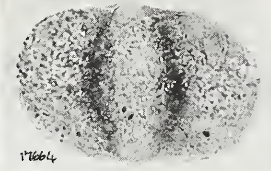

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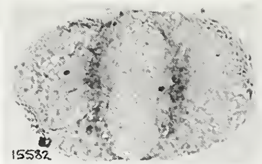

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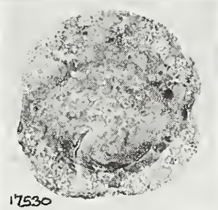

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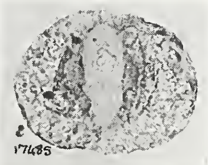

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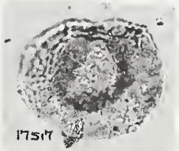
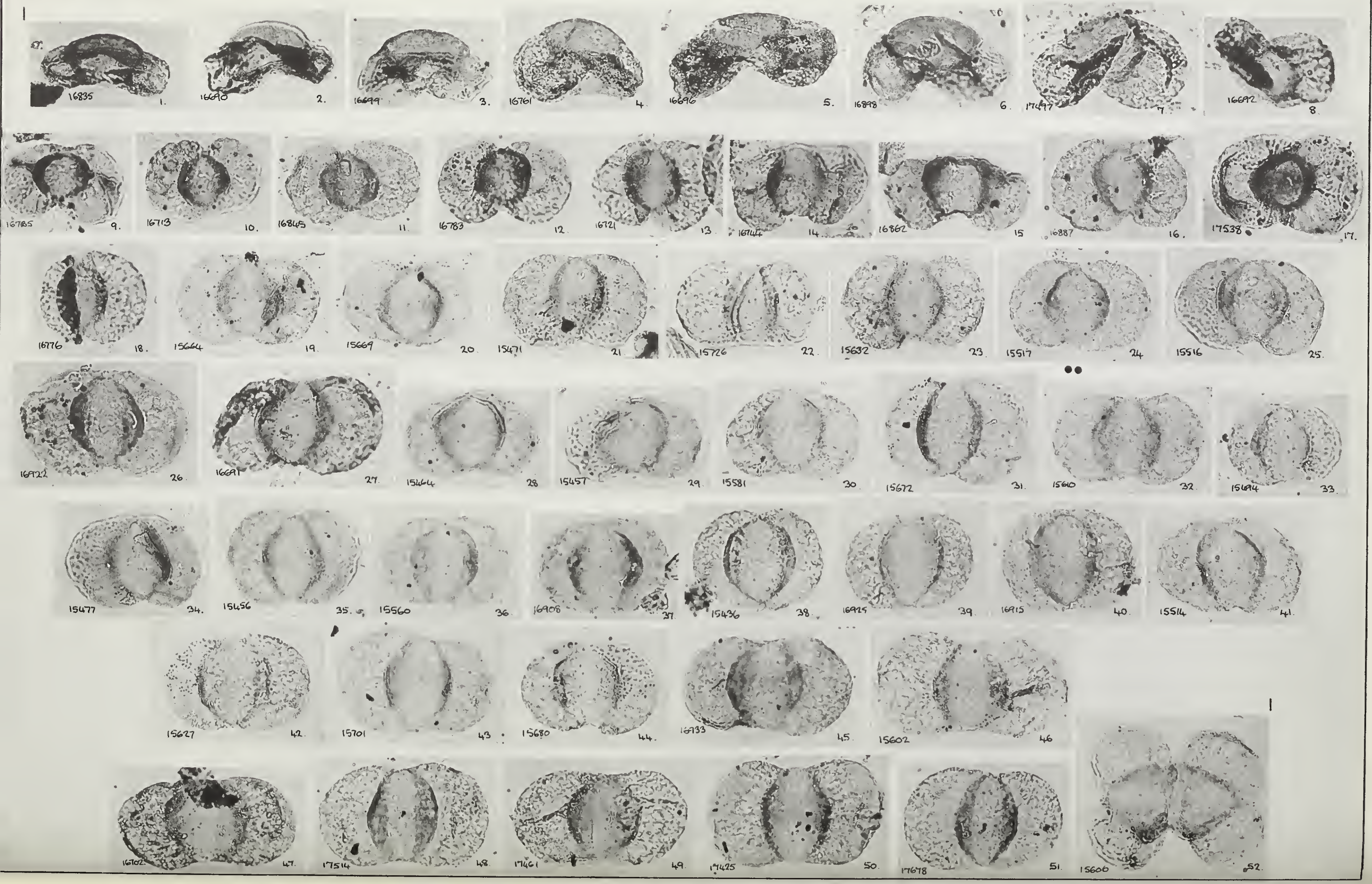


19.

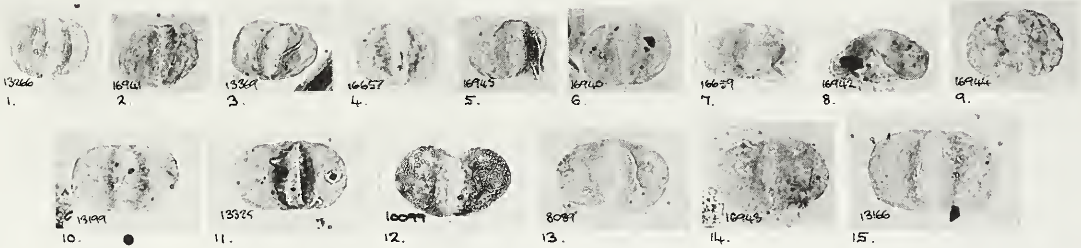
Pityosporites triassicus (Bharad. + Sriv. '69) comb. nov. / P. nucleoparvus sp. nov.
pl. 137 (in full) pl. 138 (in full)

OW 94'



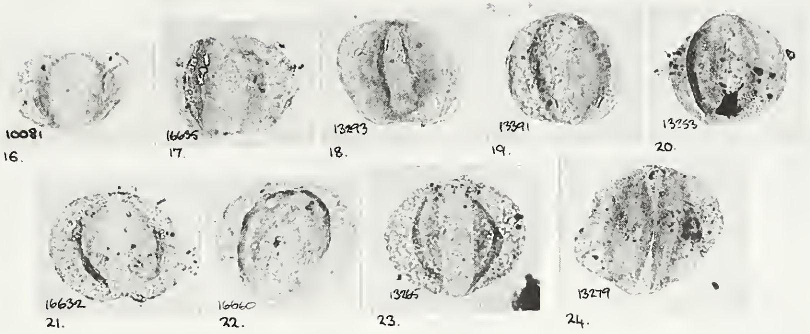
Pityosporites indarraensis (Segr.'69) comb.nov.

● Kb.



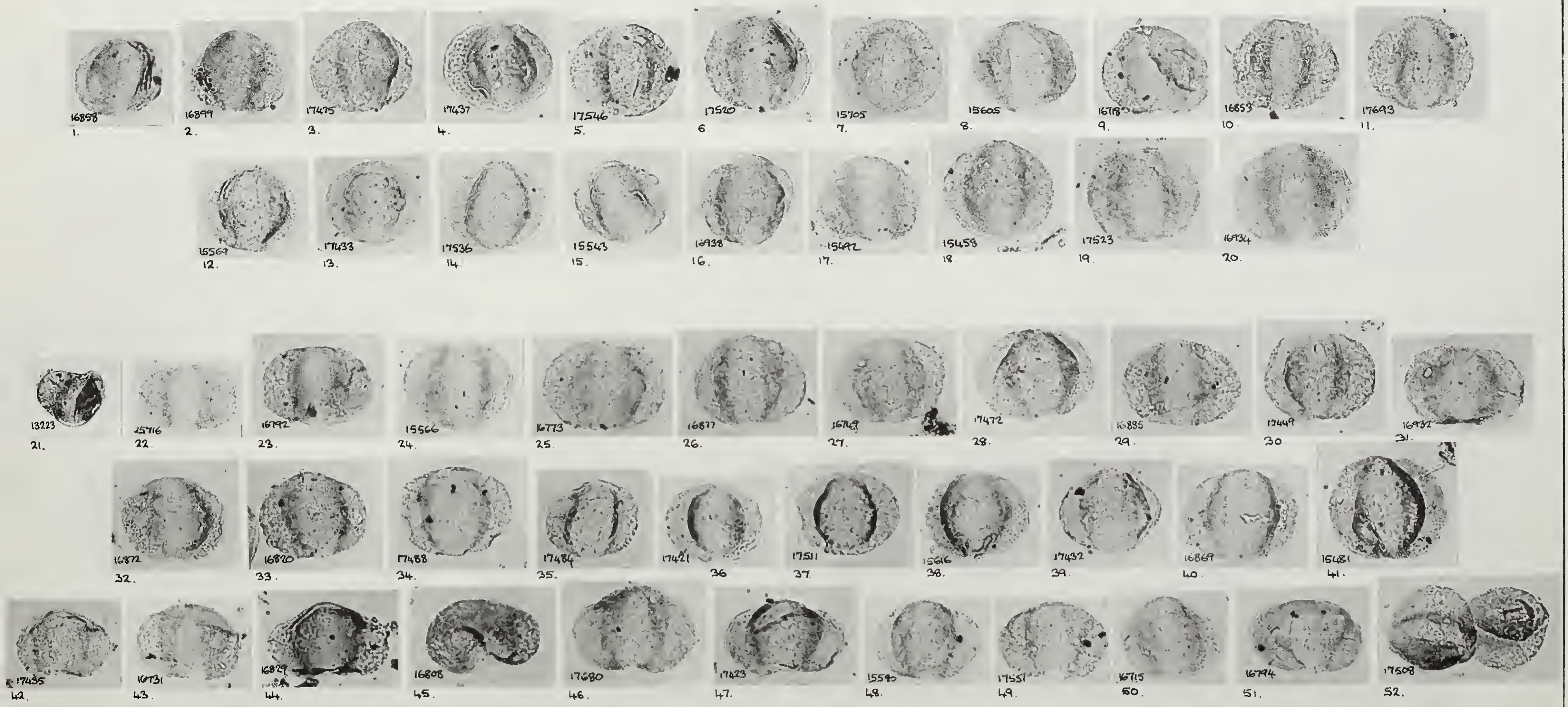
Pityosporites tenuicorpus (Balme'70) comb.nov.

o Kb.



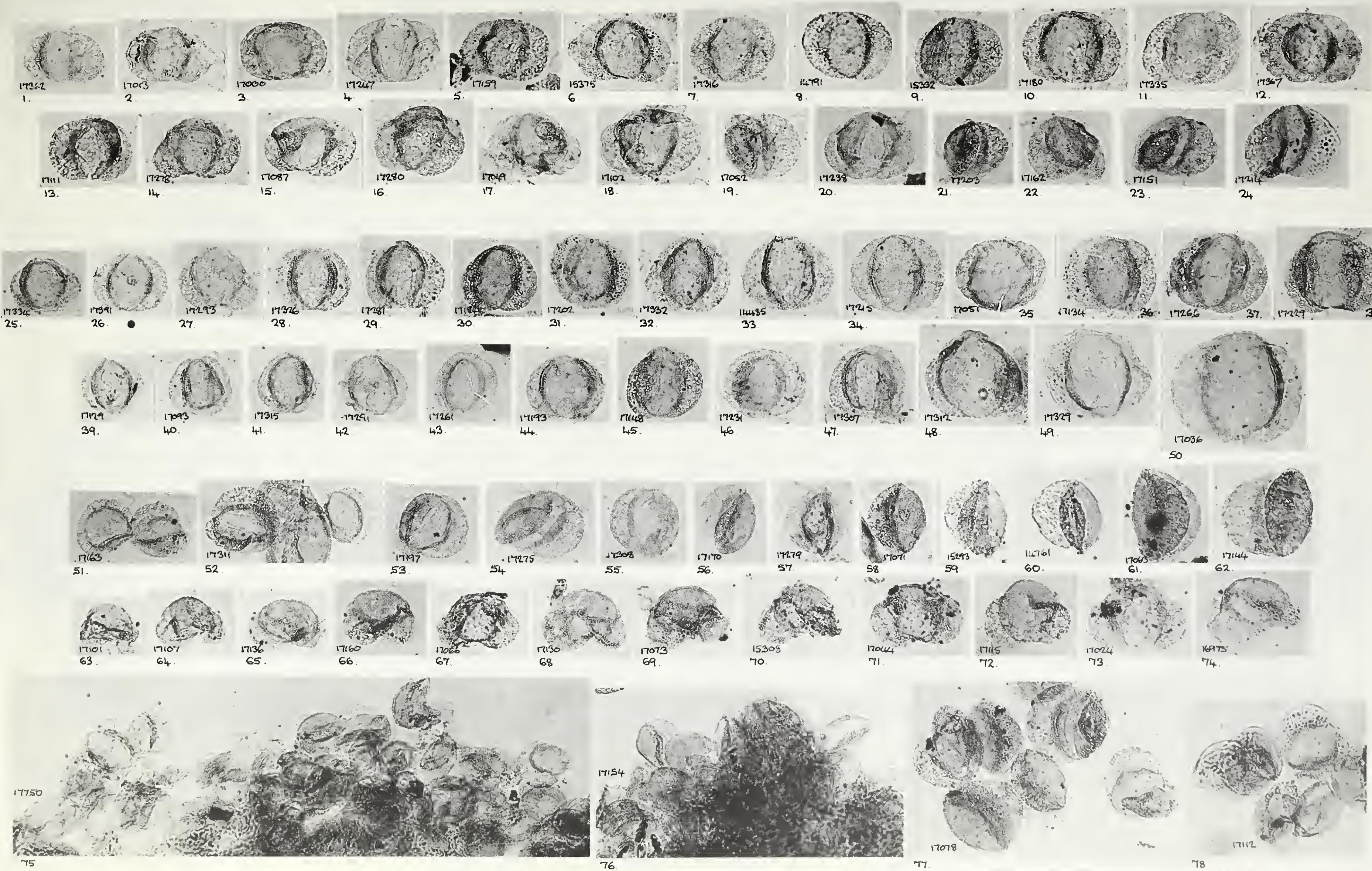
Pityosporites tenuicorpus (Balme '70) comb. nov.

0 OW 94'



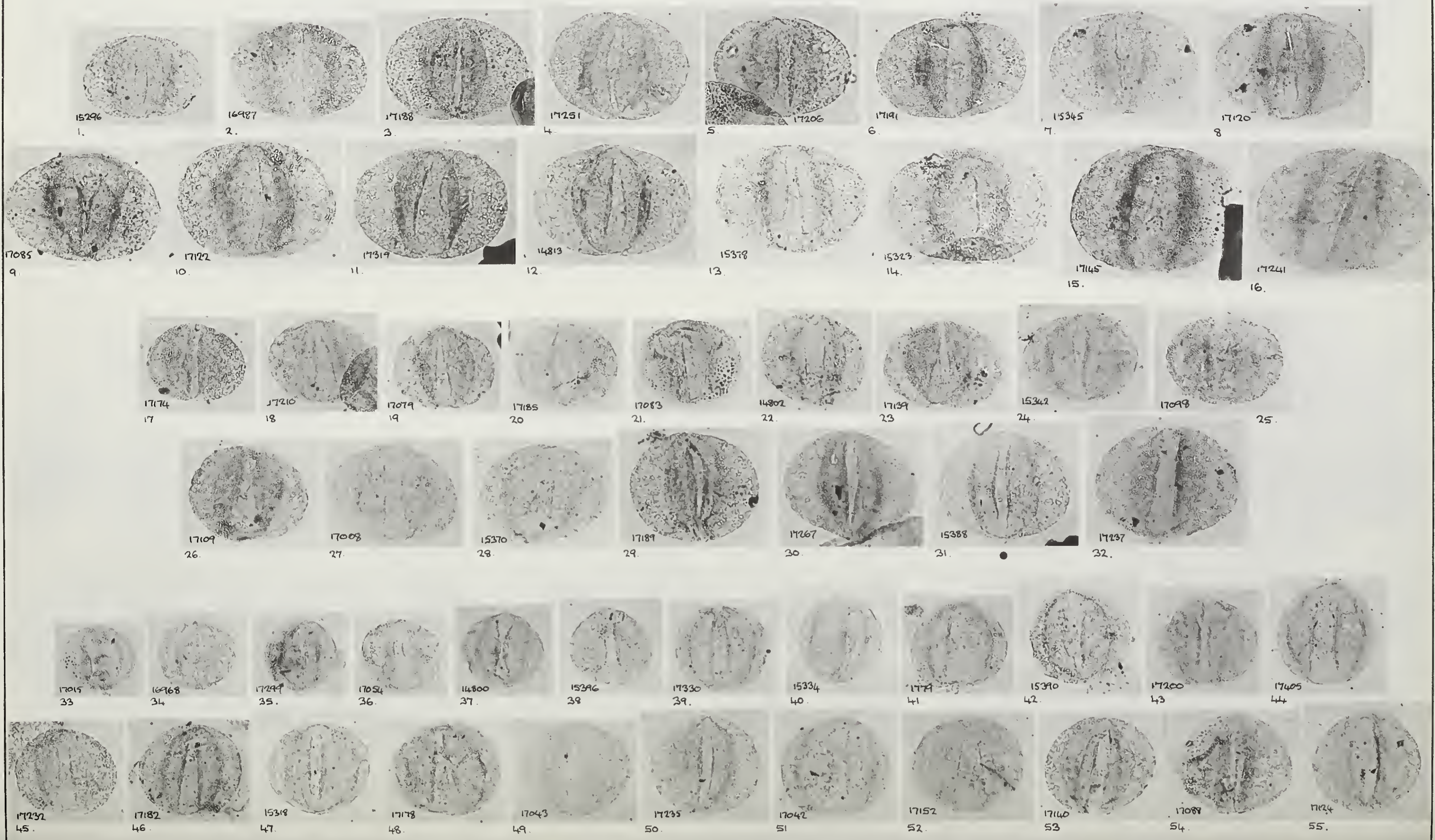
Pityosporites tenuicorpus (Balme '70) comb. nov.

● HKr.



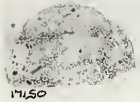
Pityosporites ovatus (Balme & Henn. '55) comb. nov.

● HKr.



Pityosporites ovatus (Balme & Henn.'55) comb. nov.

● HKr.


17150
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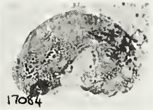
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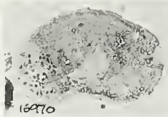
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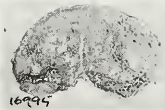
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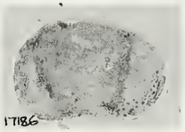
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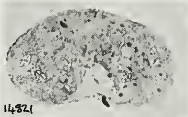
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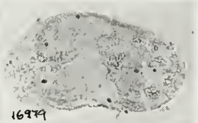
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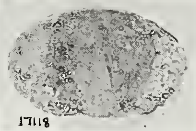
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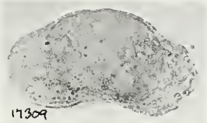
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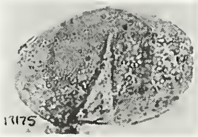
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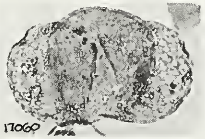
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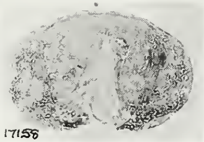
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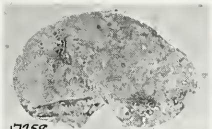
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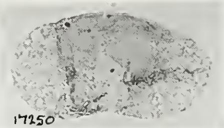
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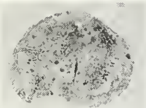
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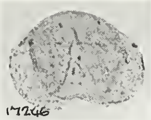
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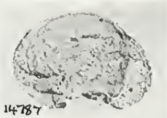
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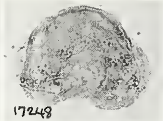
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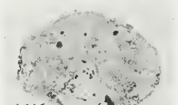
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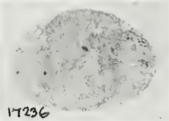
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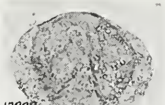
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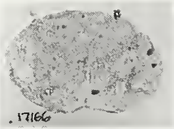
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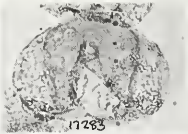
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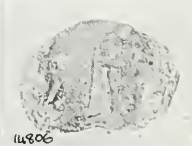
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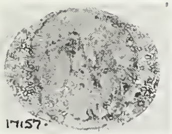
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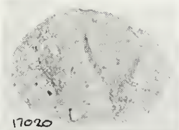
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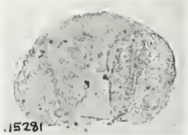
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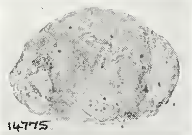
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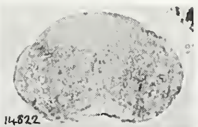
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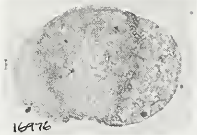
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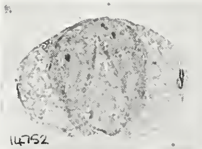
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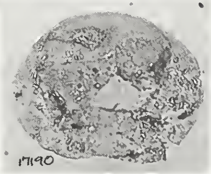
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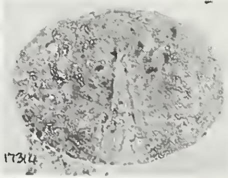
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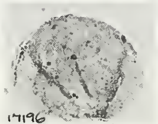
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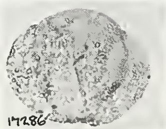
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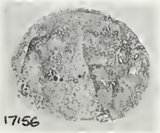
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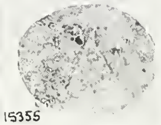
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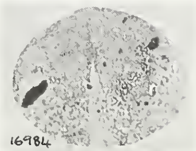
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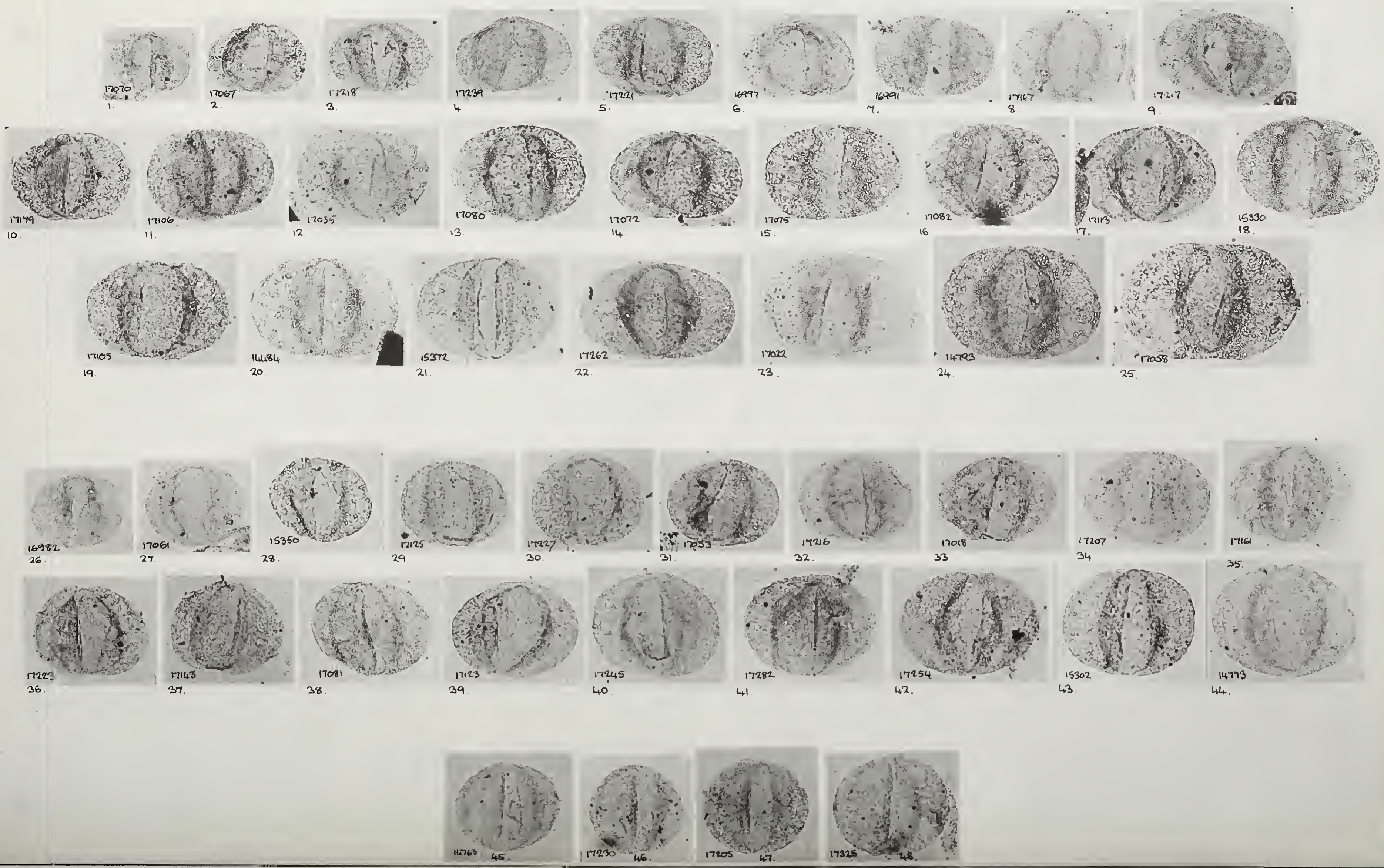
Pityosporites ovatus (Balme & Henn.'55) comb. nov.

● HKr.



Pityosporites ovatus (Balme+Henn.'55) comb.nov.

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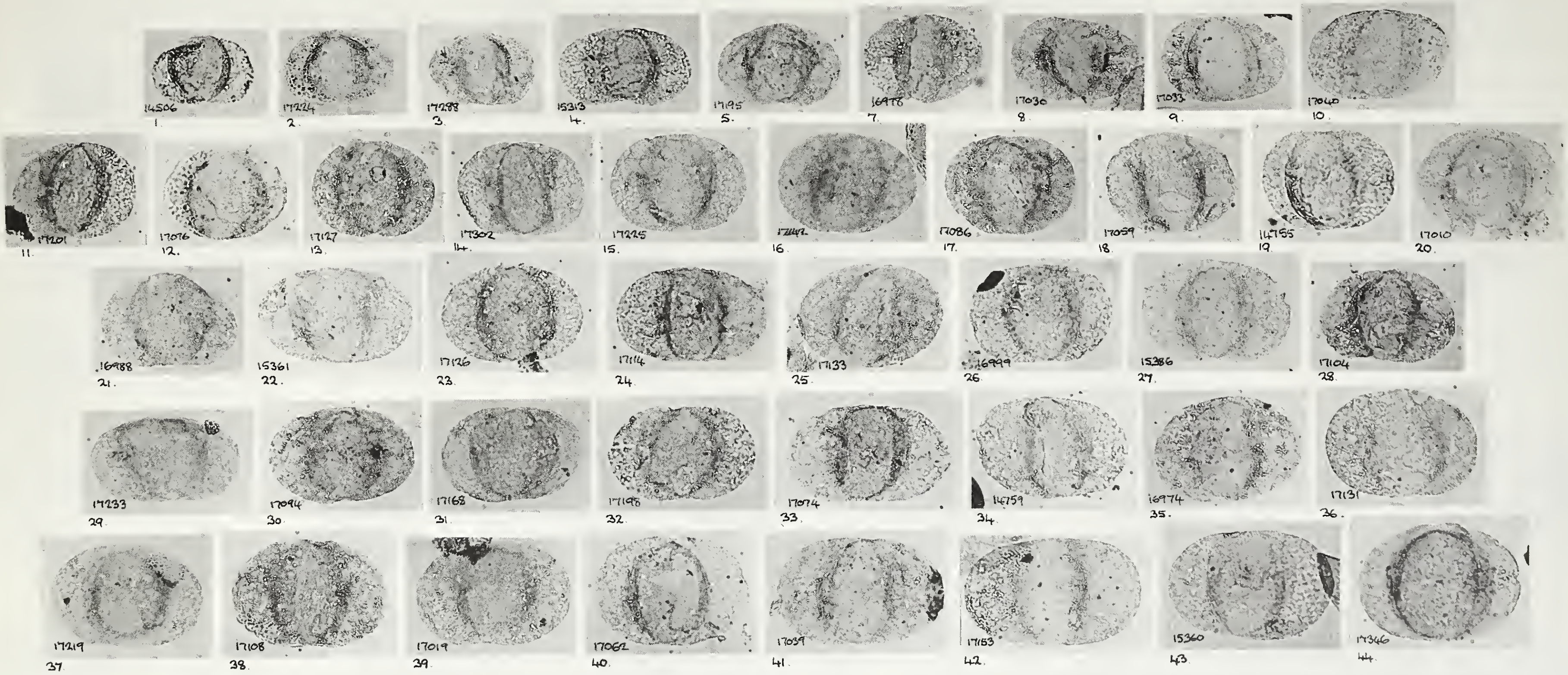

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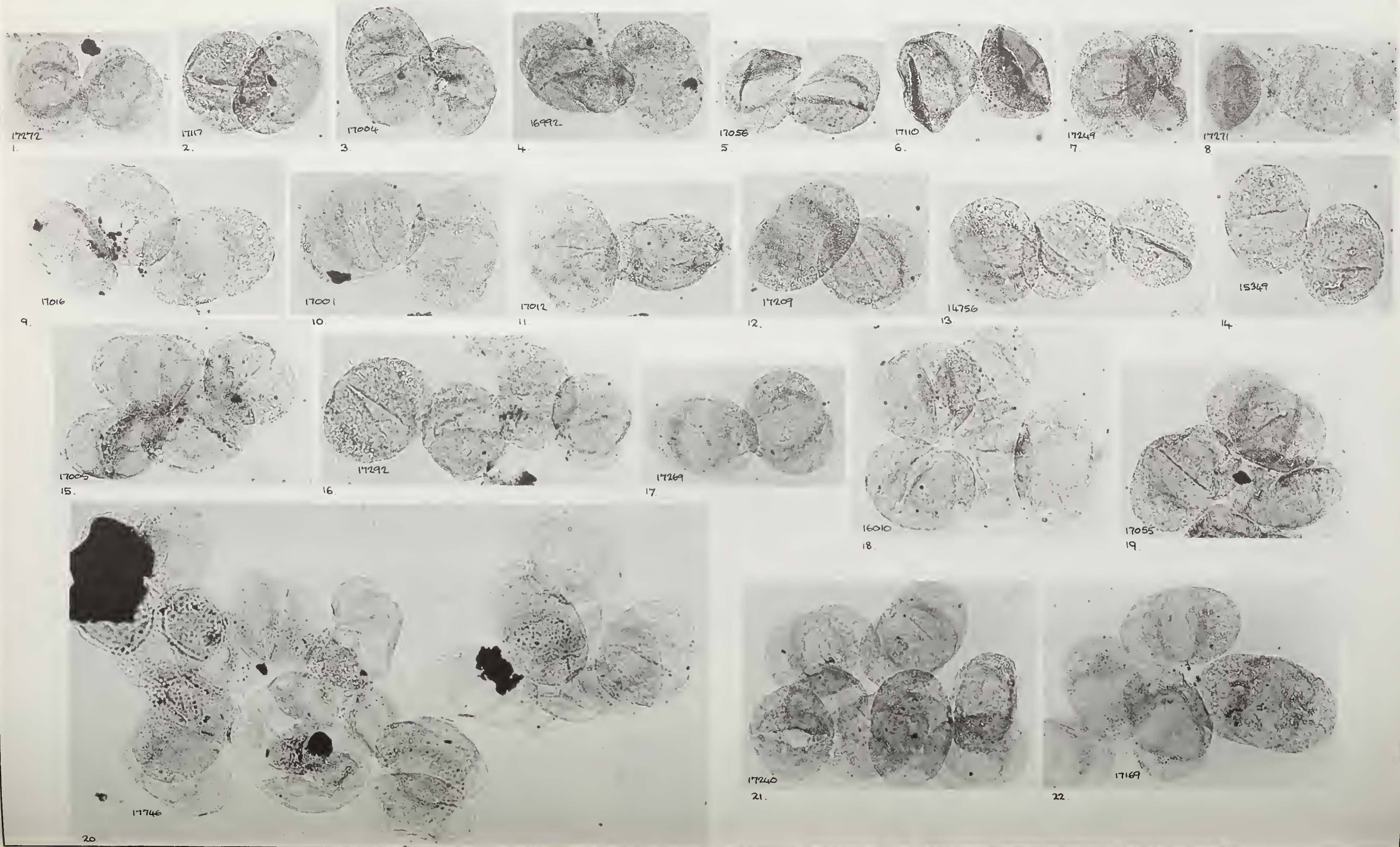

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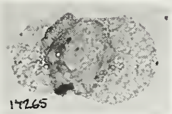

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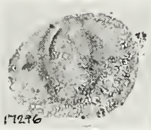

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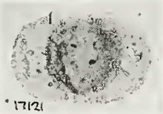

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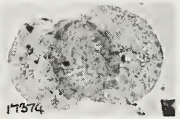

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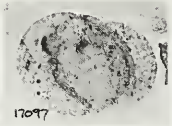

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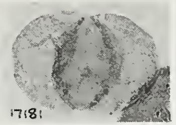

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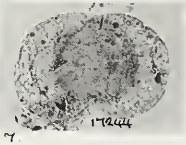

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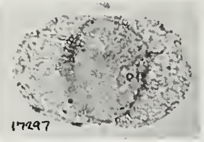

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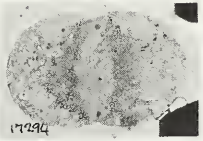

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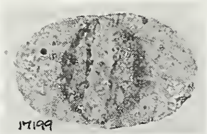

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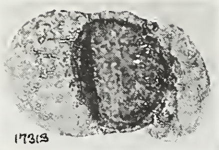

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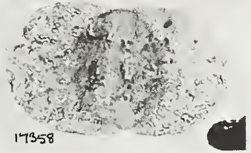

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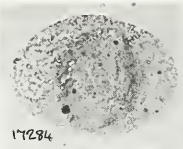

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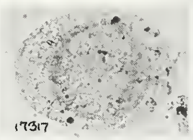

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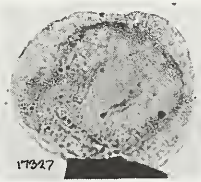

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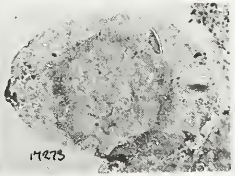

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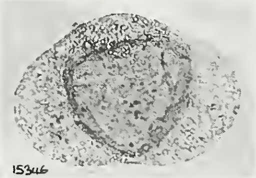

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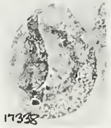

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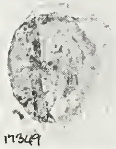

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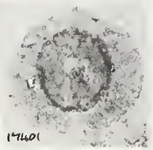

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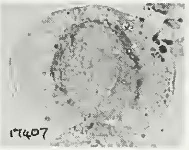

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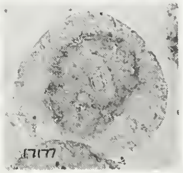

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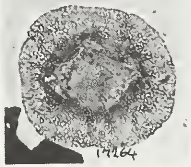
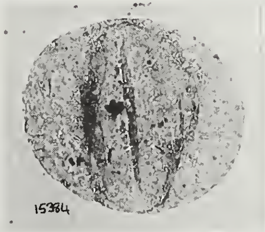


23

Pityosporites maximus (Hart '60) comb. nov.

● HKr.



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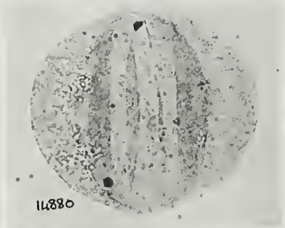

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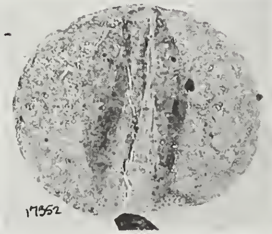

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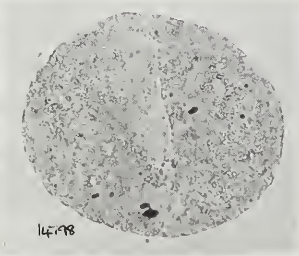

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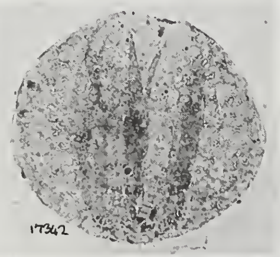

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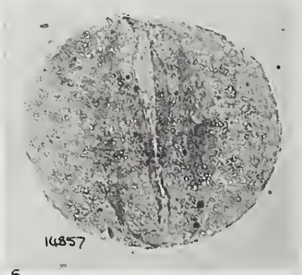

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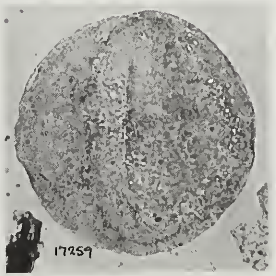

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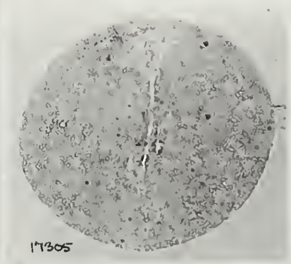

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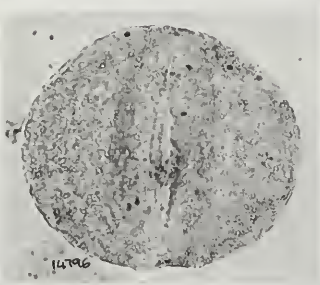

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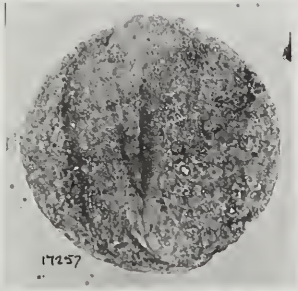

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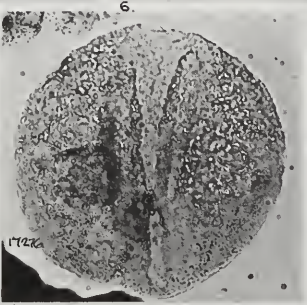

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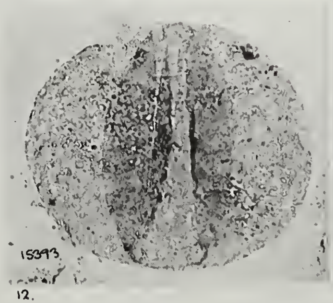

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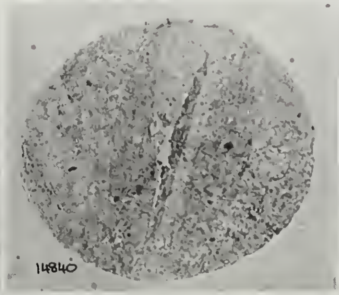

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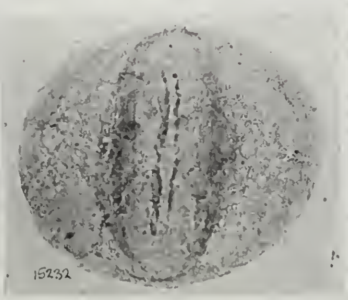

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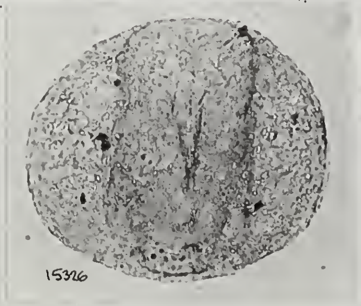

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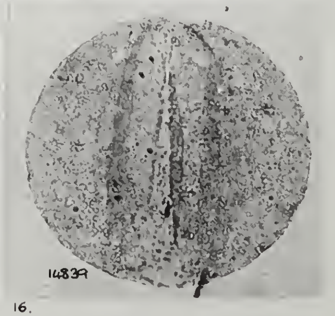
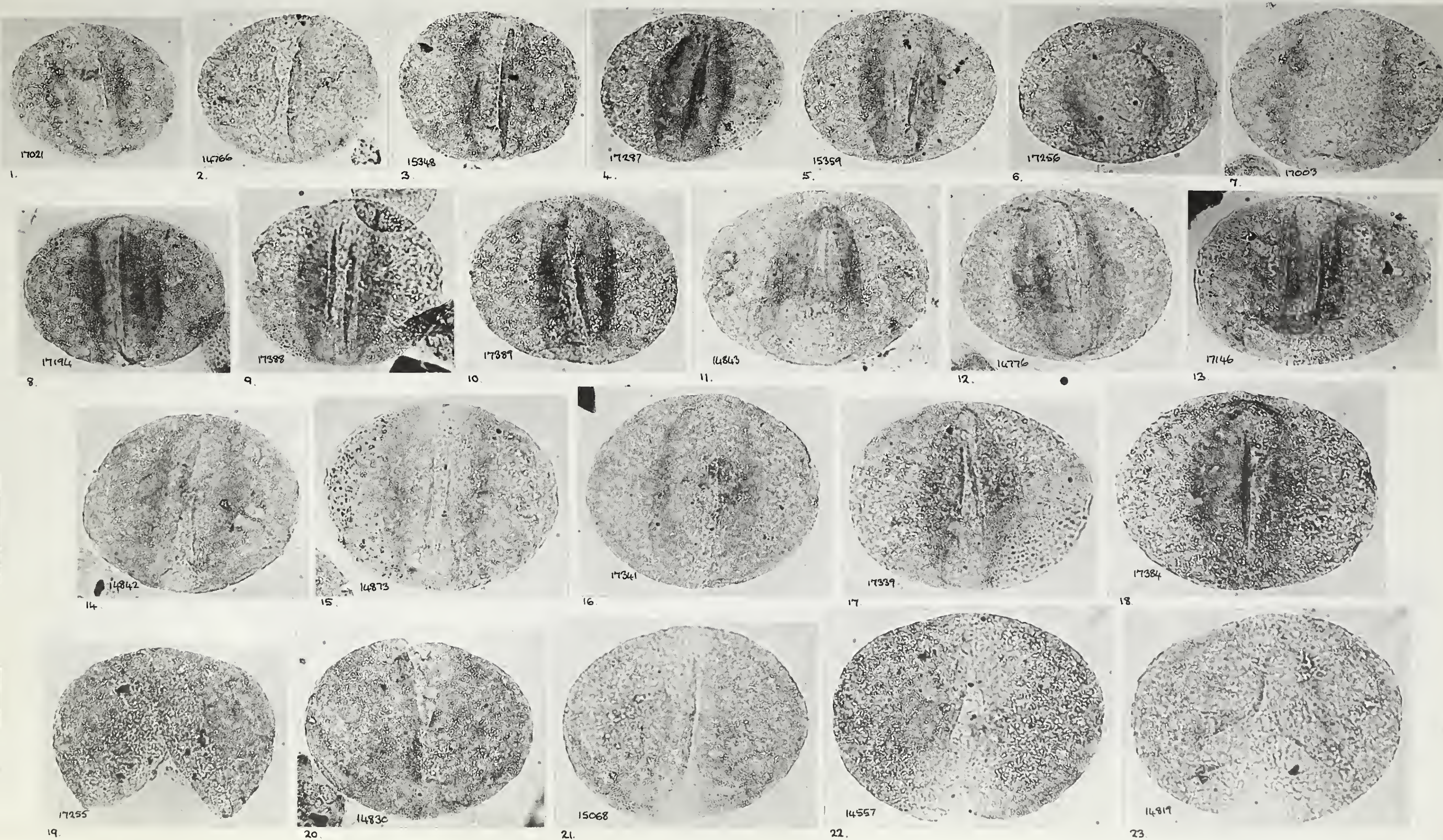


16.

Pityosporites maximus (Hart '60) comb. nov.

● HKr.



Pityosporites maximus (Hart '60) comb. nov.

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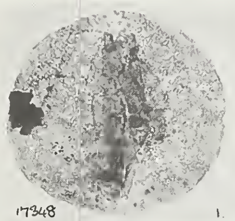
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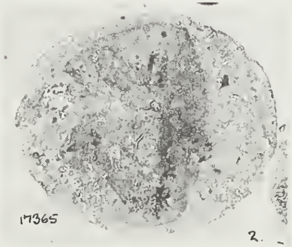
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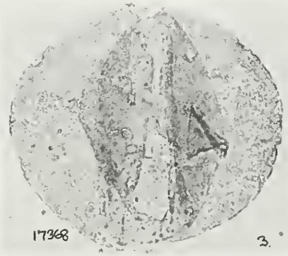
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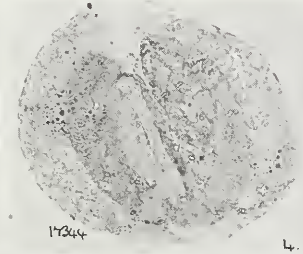
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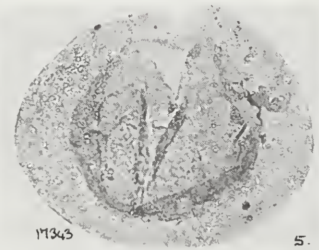
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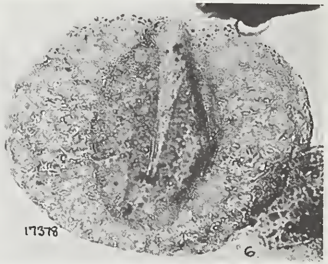
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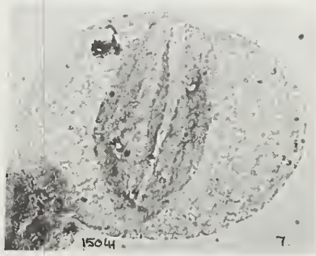
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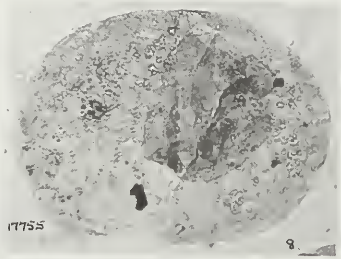
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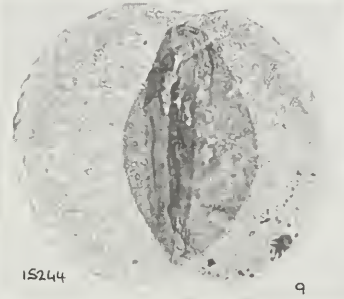
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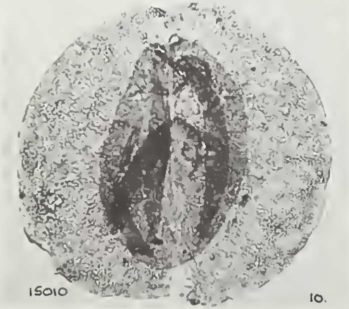
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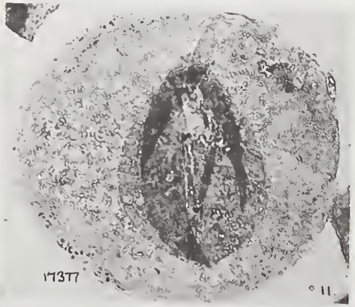
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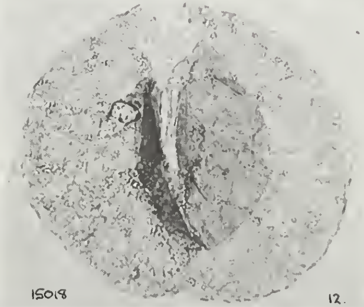
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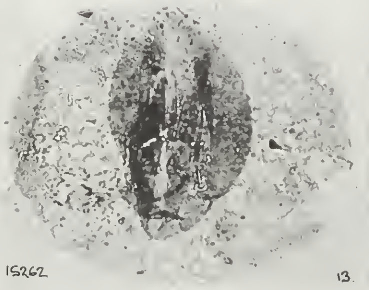
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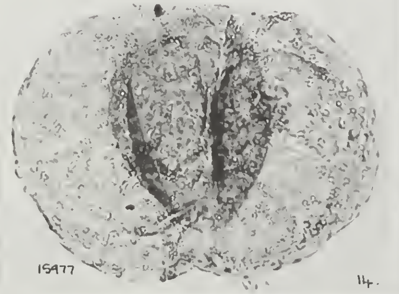
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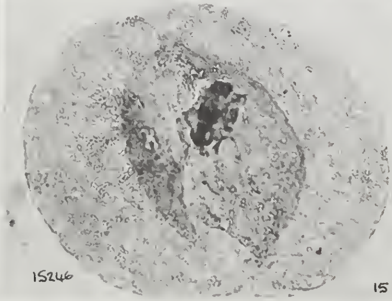
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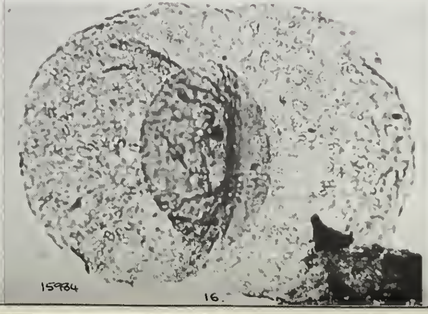
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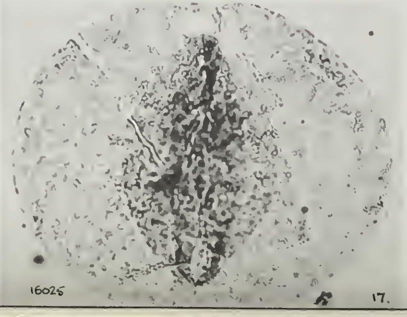
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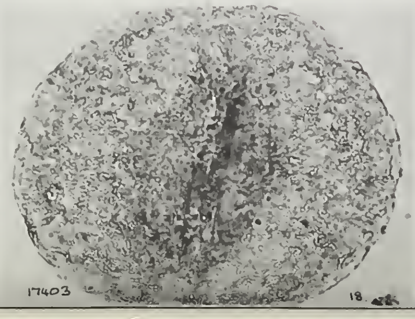
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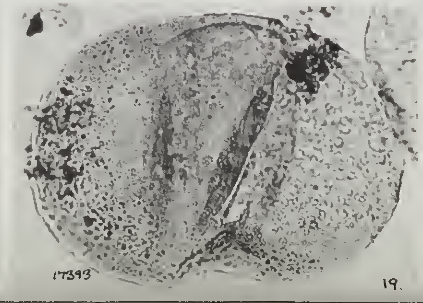
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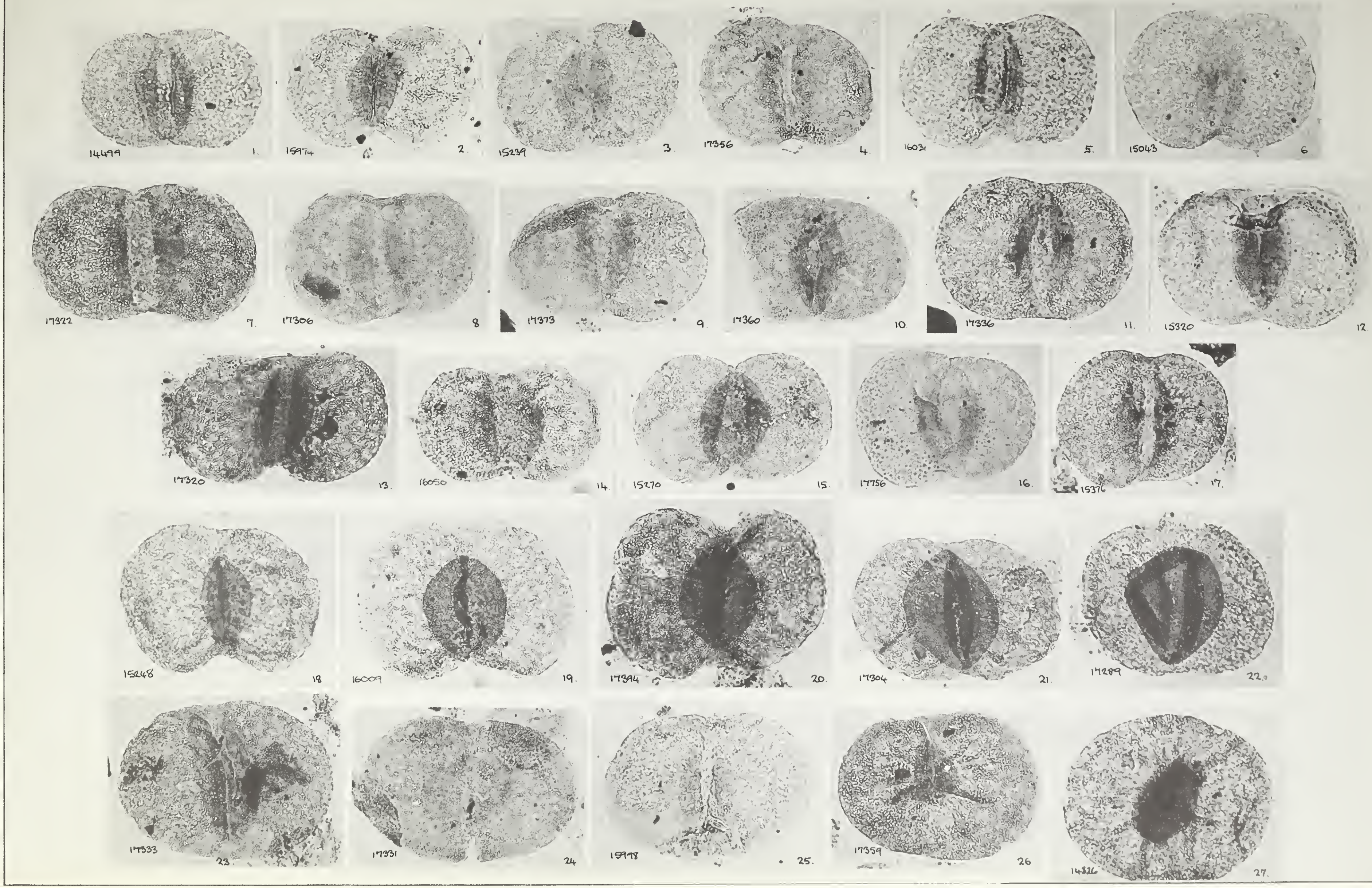
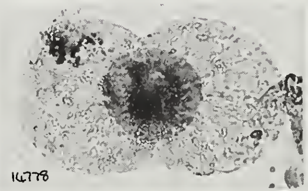
Pityosporites Levis (Tiw.'64) comb.nov.

● HKr.



Pityosporites Levis (Tiw. '64) comb. nov.

● HKr.



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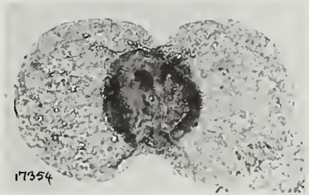

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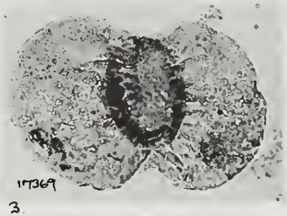

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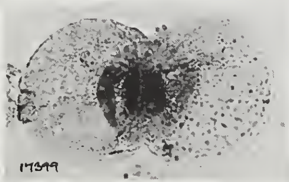

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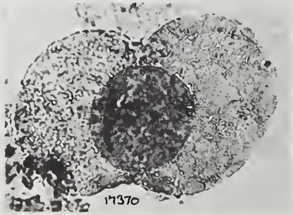

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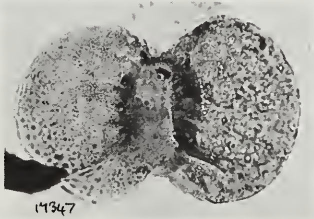

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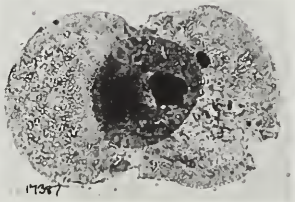

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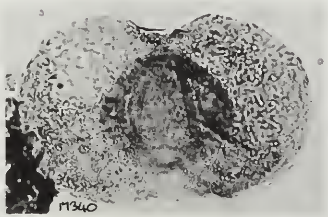

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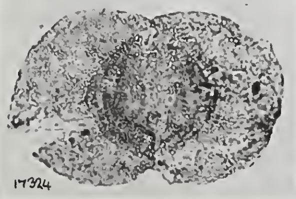

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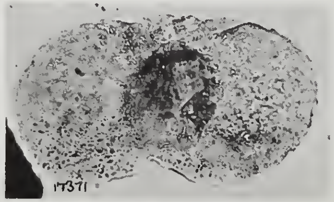

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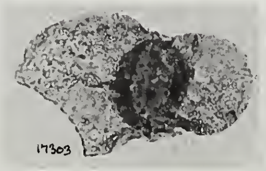

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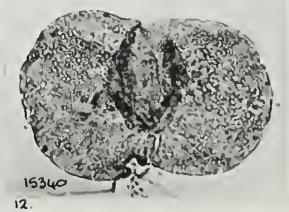

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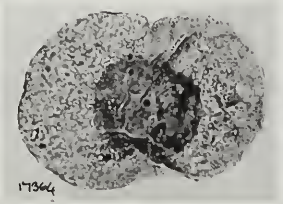

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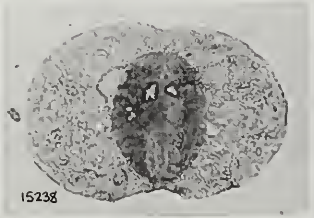

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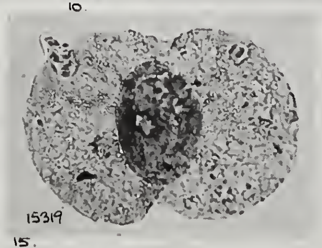

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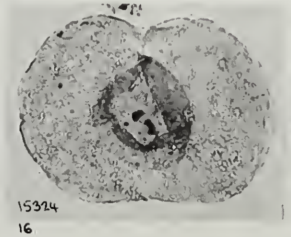

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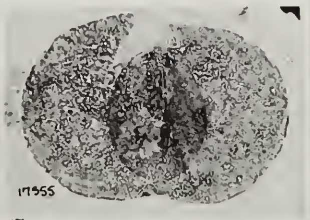

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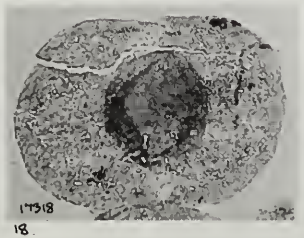

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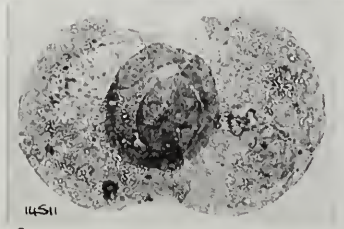

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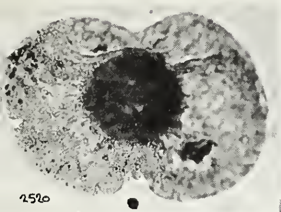
Pityosporites fusus (Balme+Henn.'55) comb.nov.

● HKr.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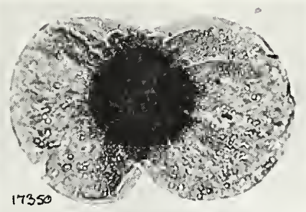
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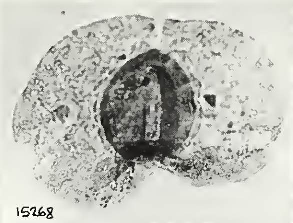
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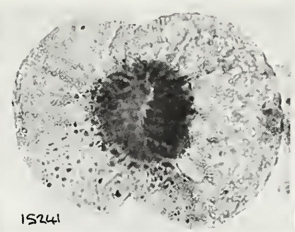
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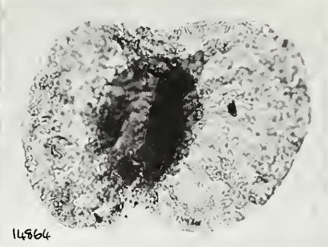
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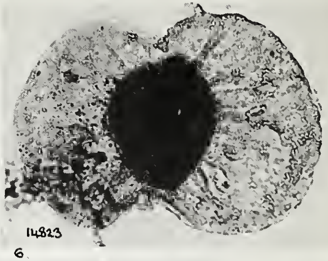
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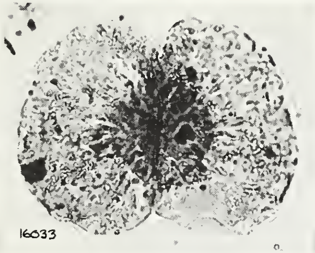
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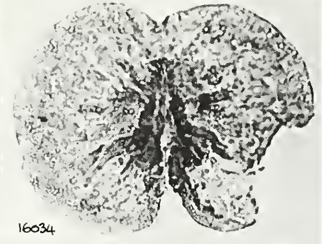
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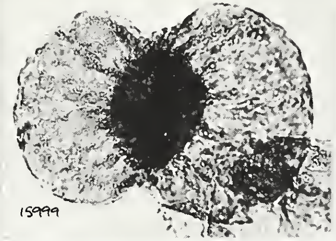
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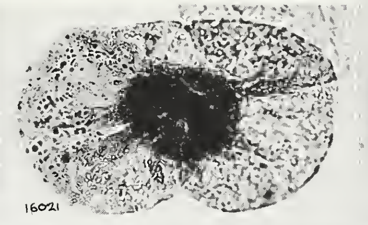
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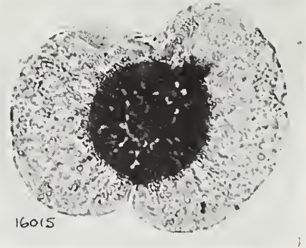
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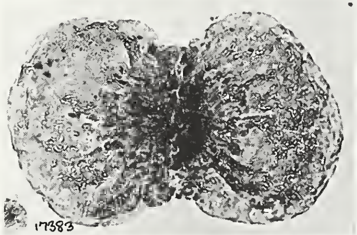
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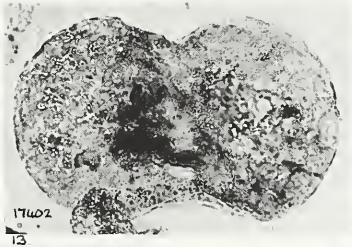
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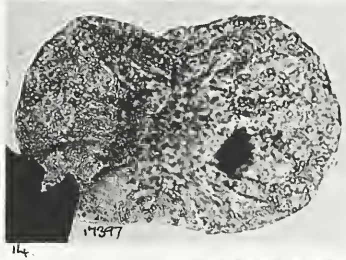
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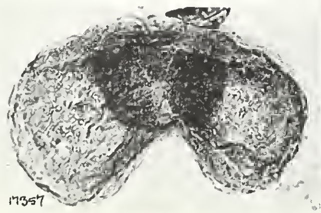
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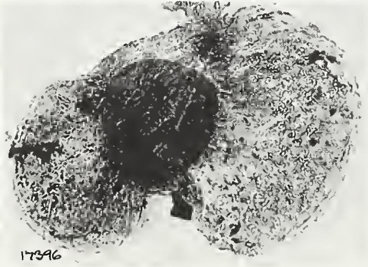
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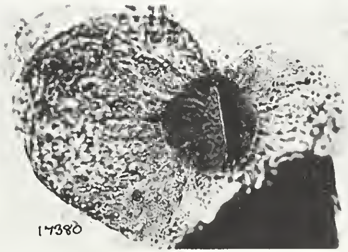
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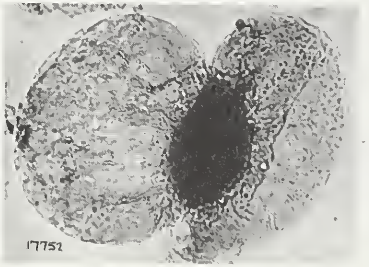
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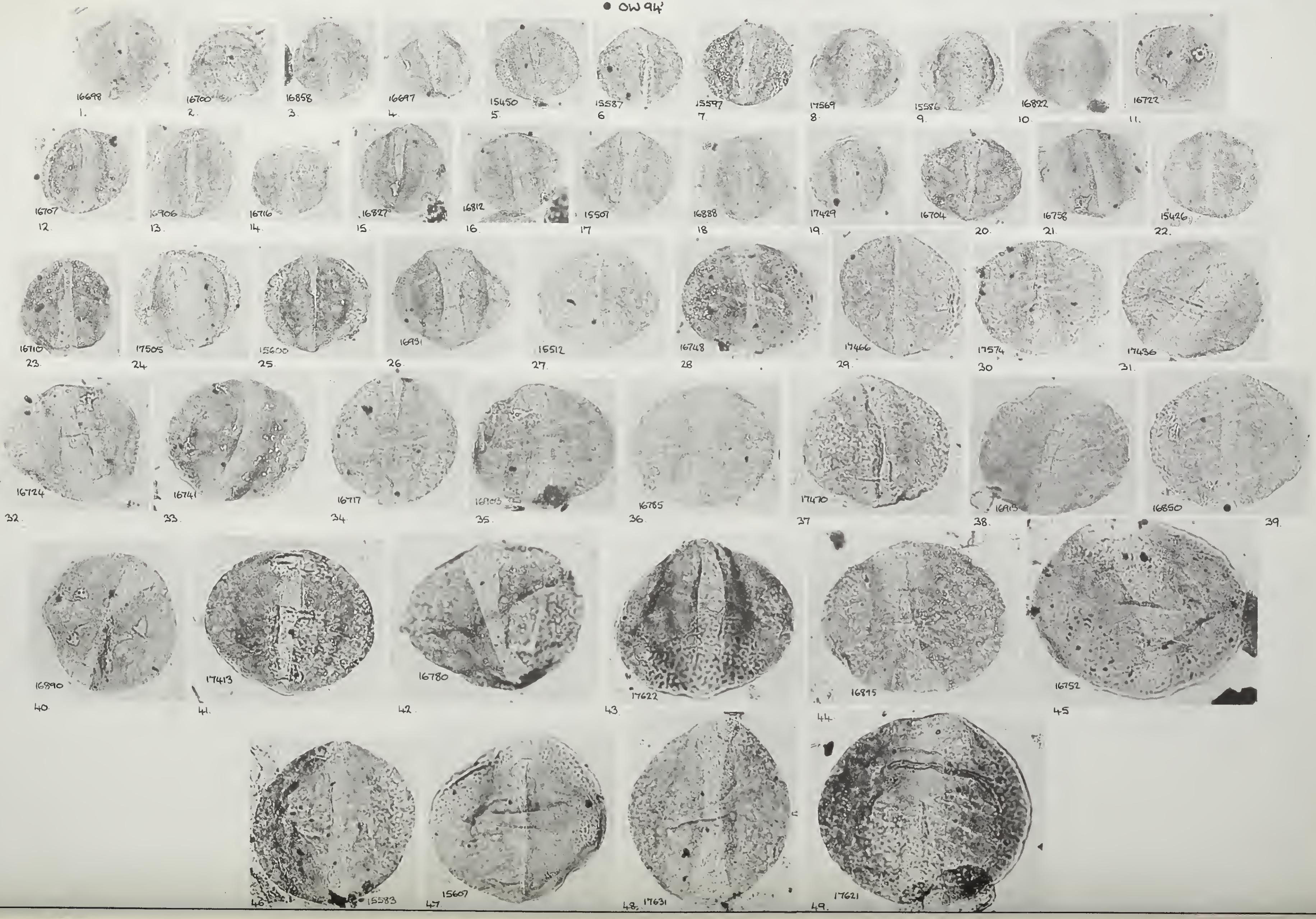
18.

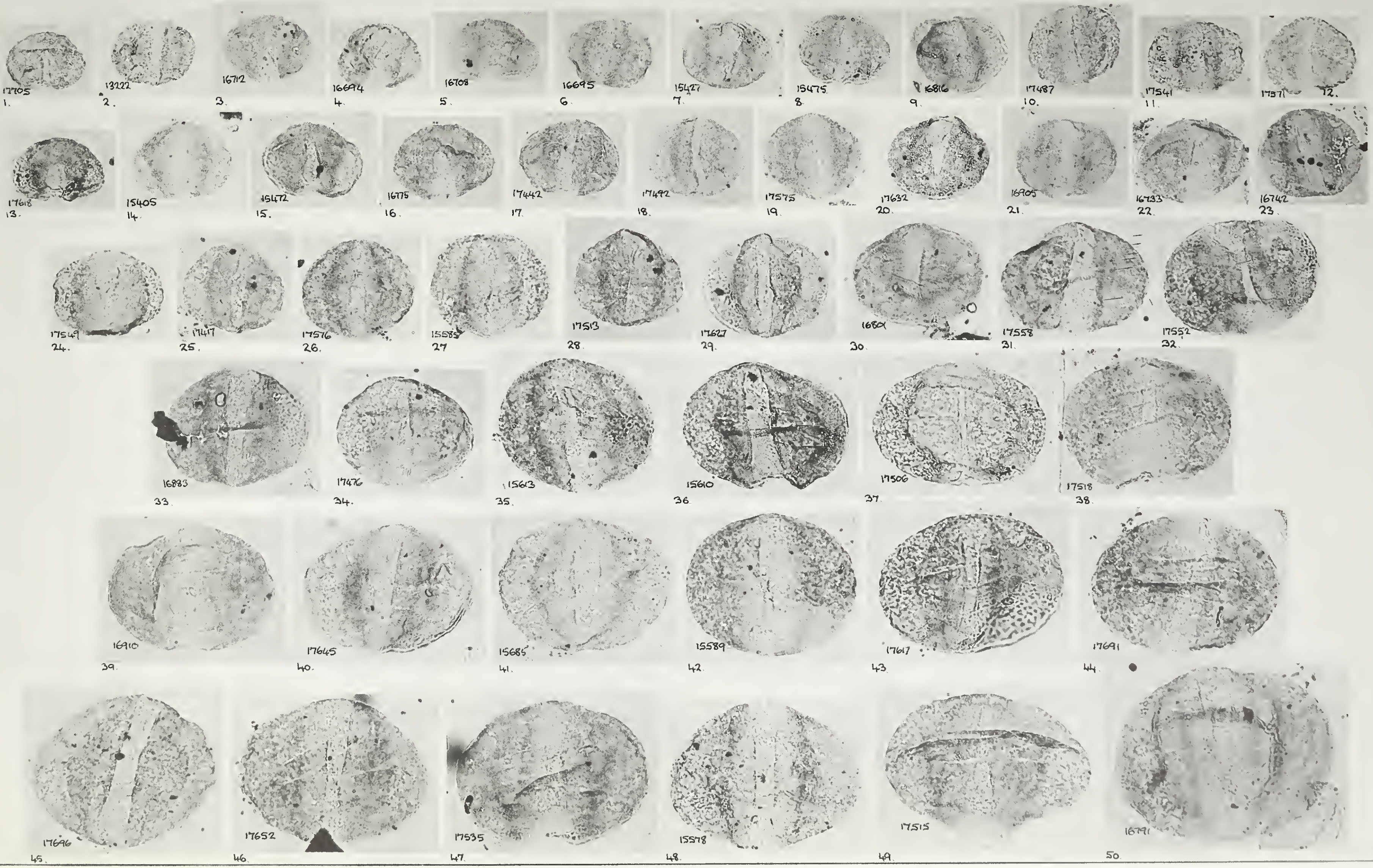
Pityosporites goraiensis (Pot.+Lele'61) comb. nov.

● OW 94'



Pityosporites goraiensis (Pot + Lele '61) comb. nov.

● OW 94'



Pityosporites goraiensis (Pot.+Lele'61) comb.nov.

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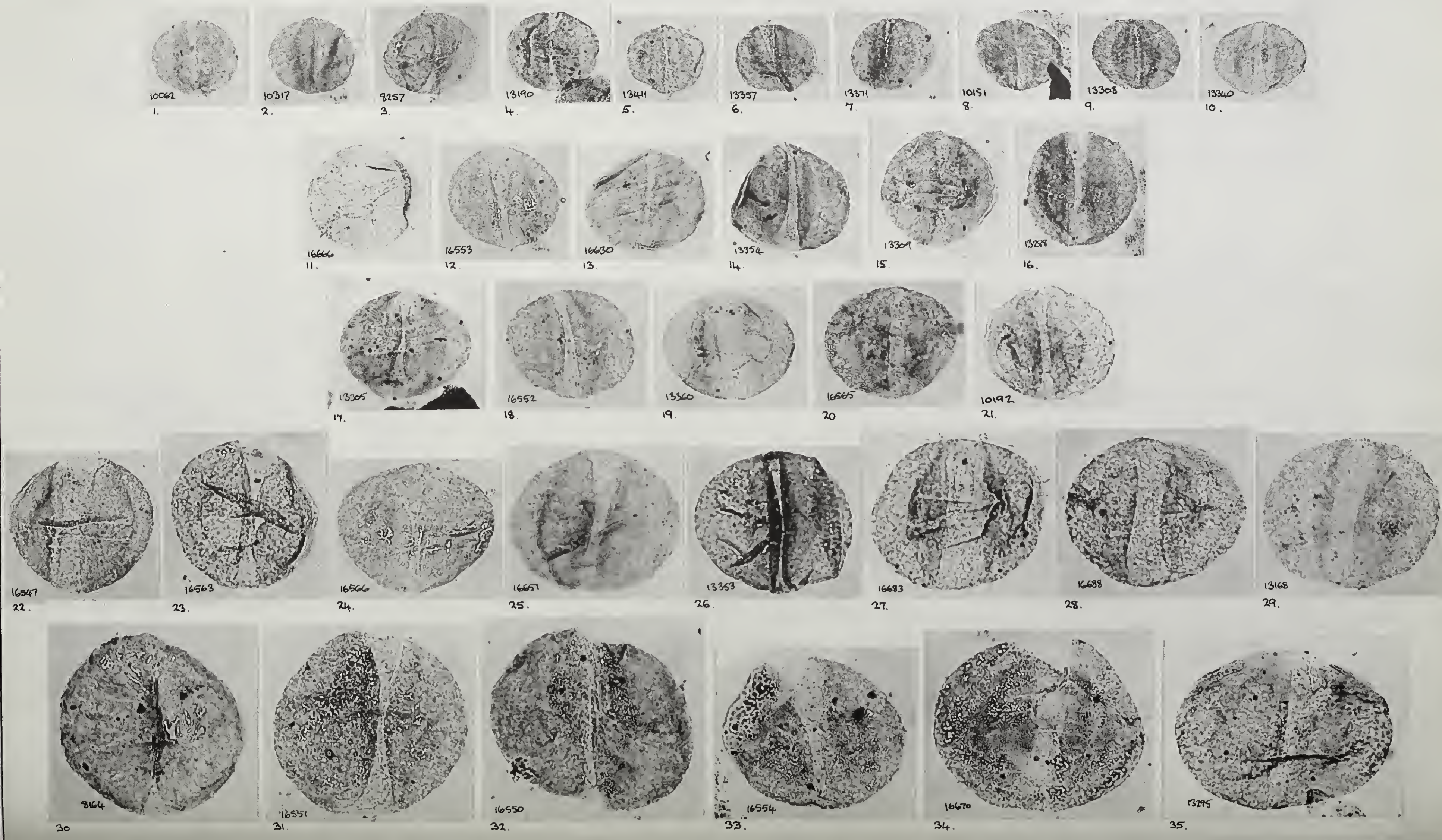
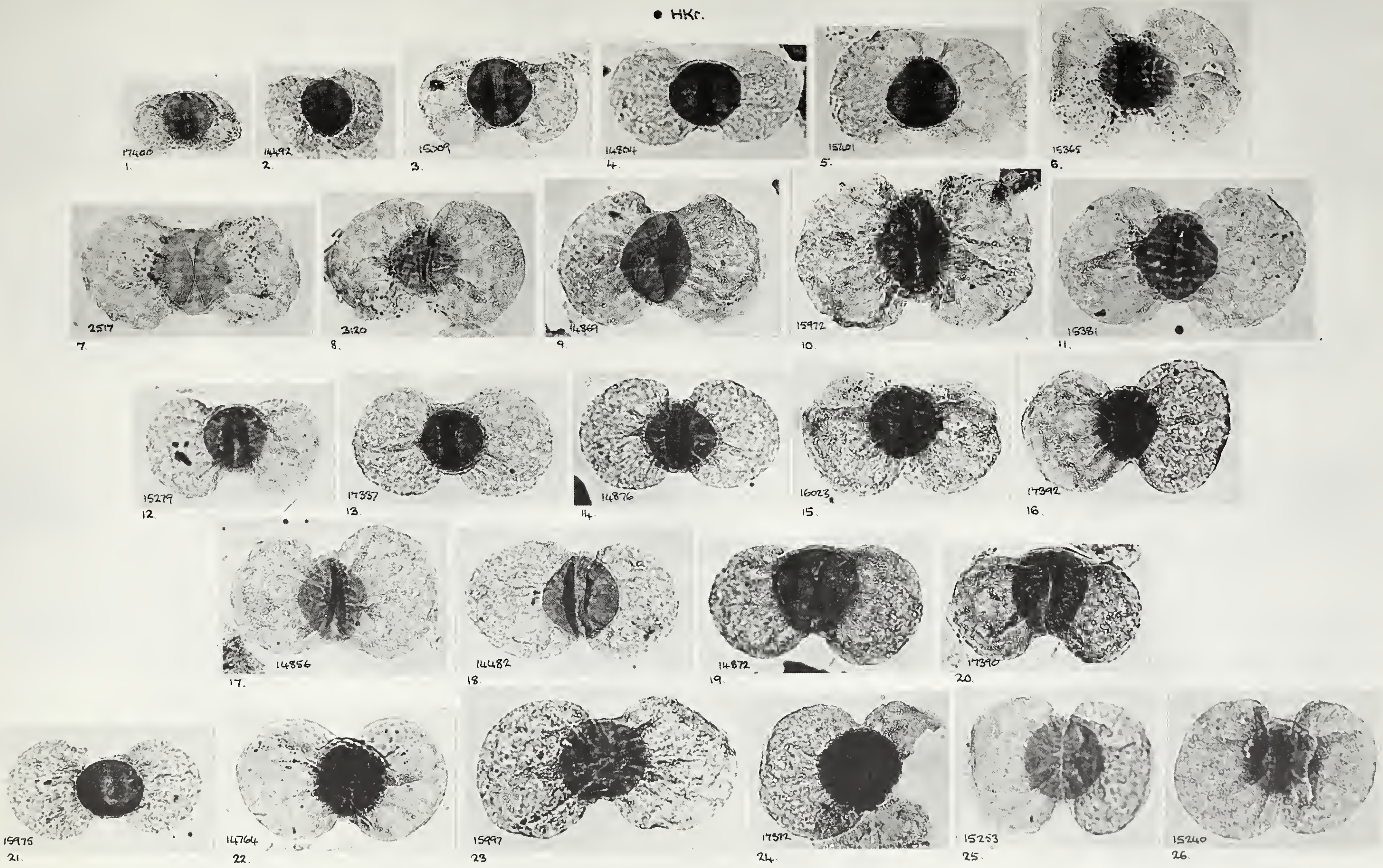


Pityosporites cancellatus (Balme+Henn.'55) comb. nov.

● HKr.



Pityosporites cancellatus (Balme & Henn.'55) comb. nov.

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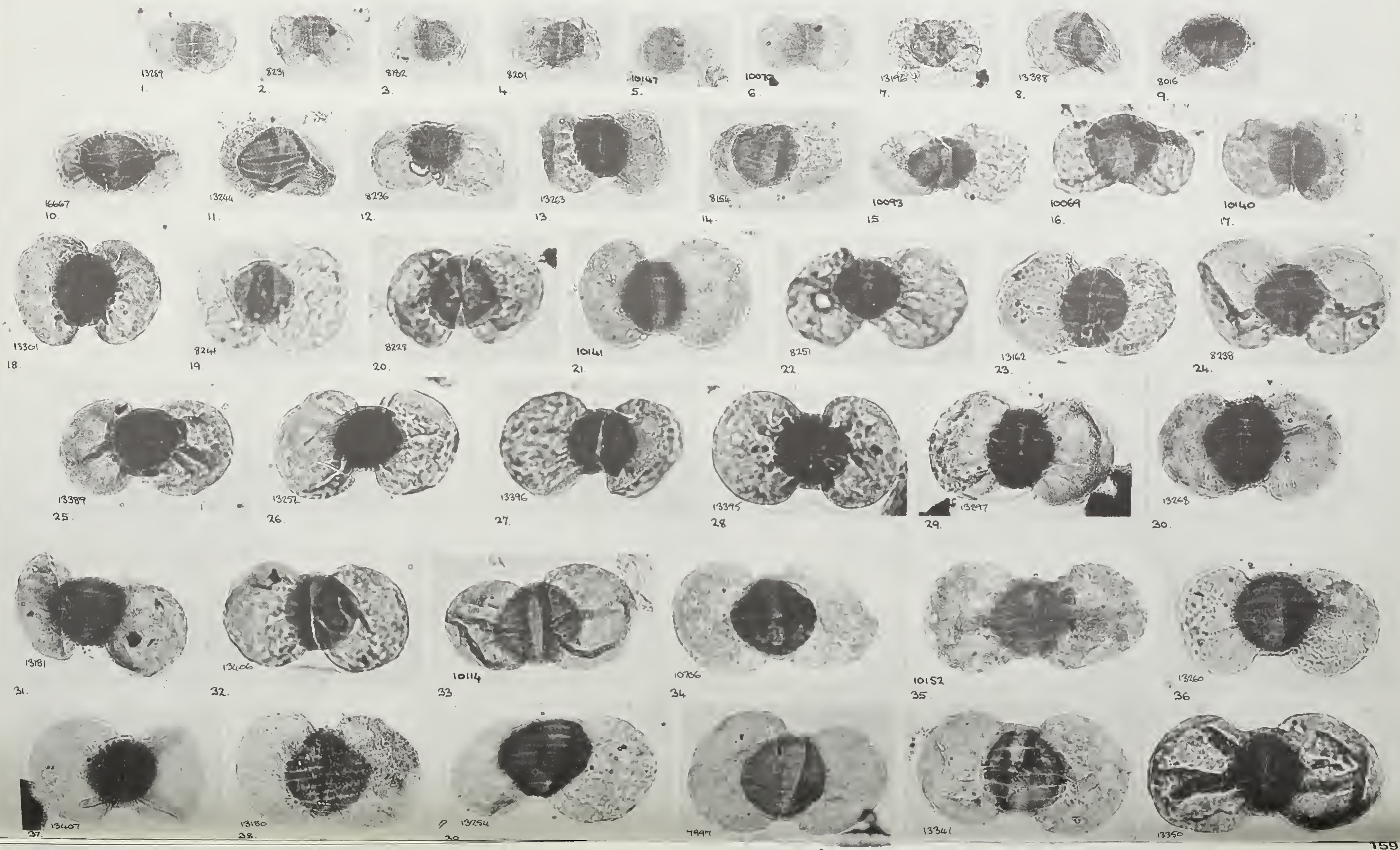
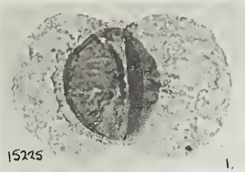


Pityosporites amplus (Balme+Henn.'55) comb.nov.

● HKr.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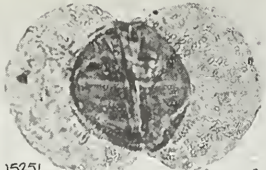
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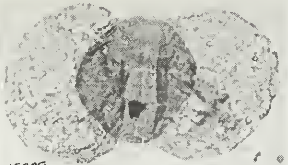
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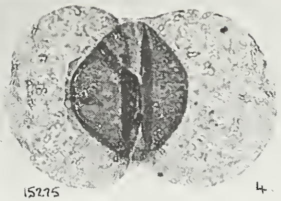
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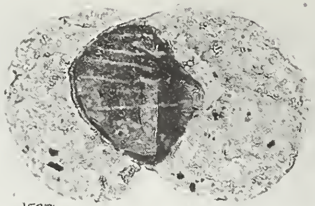
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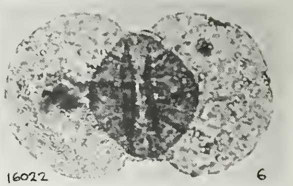
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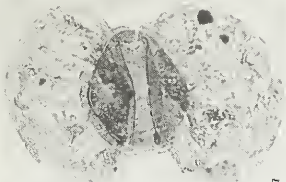
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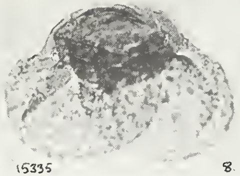
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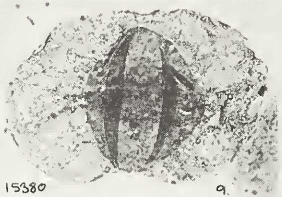
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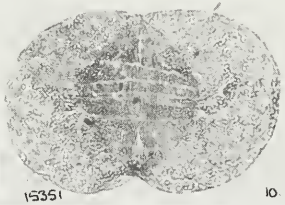
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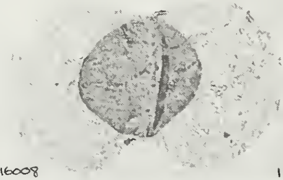
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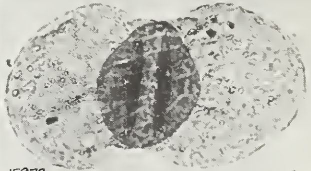
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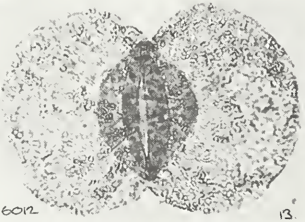
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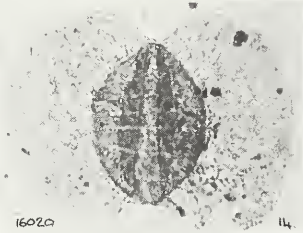
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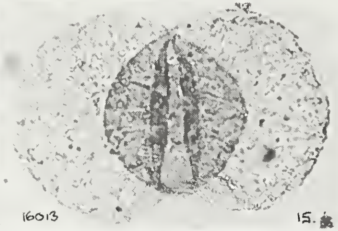
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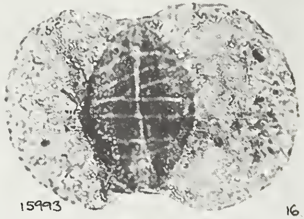
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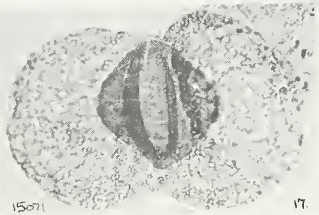
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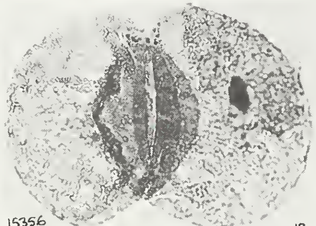
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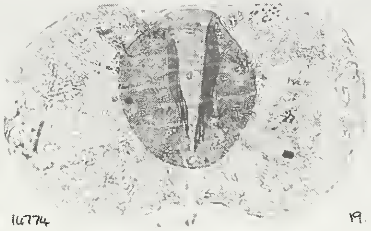
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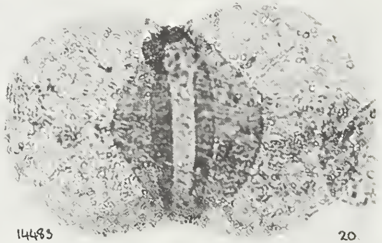
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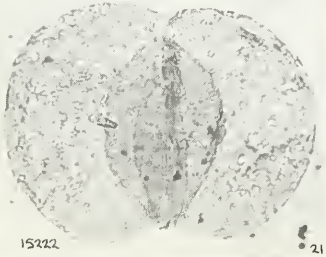
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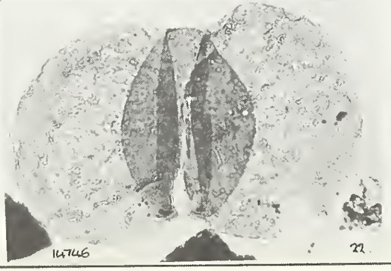
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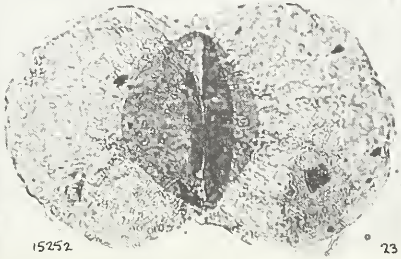
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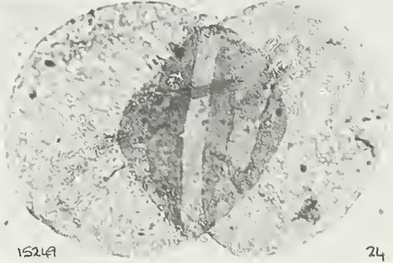
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Pityosporites amplus (Balme & Henn.'55) comb. nov.

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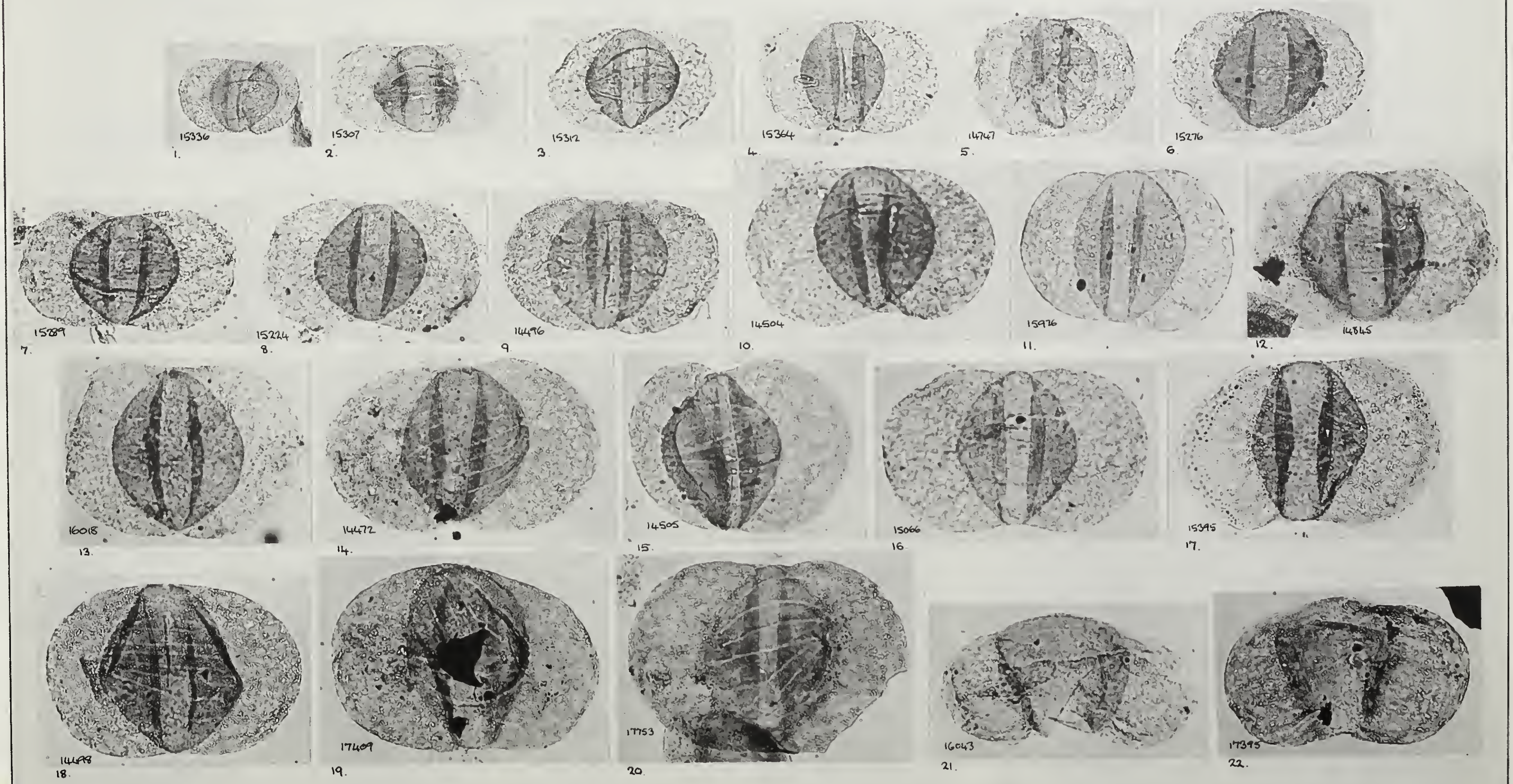

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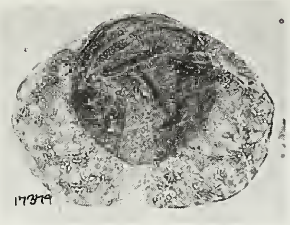

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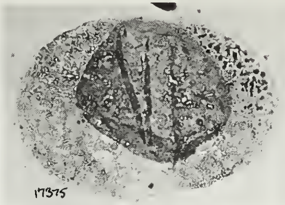

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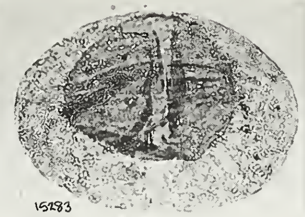

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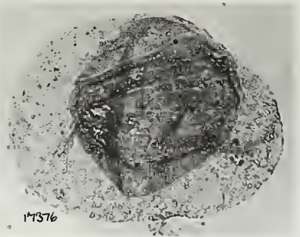

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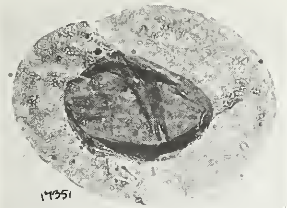

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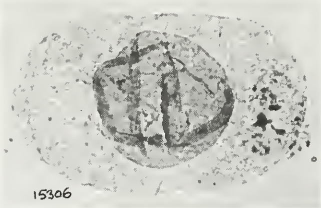

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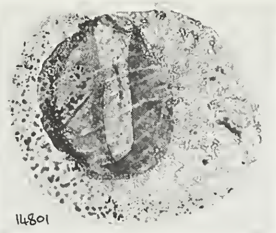

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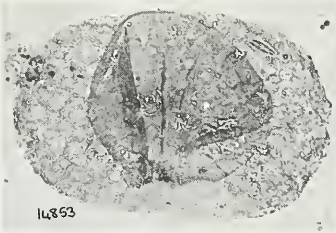

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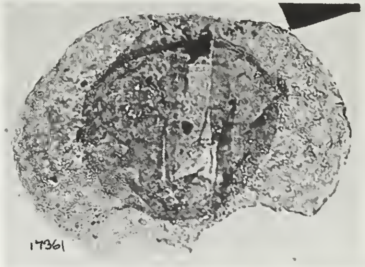

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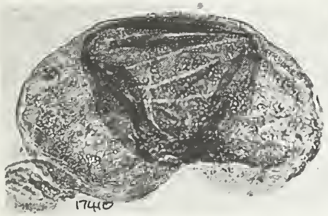

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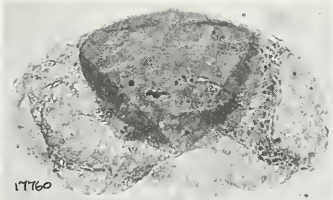

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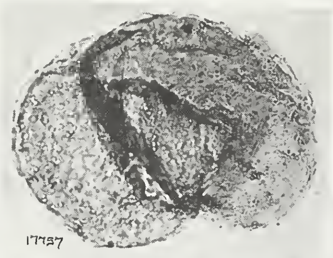

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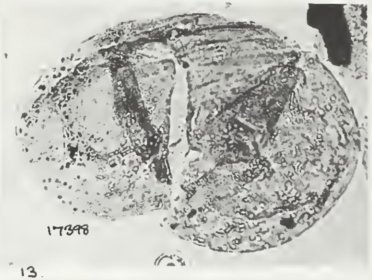

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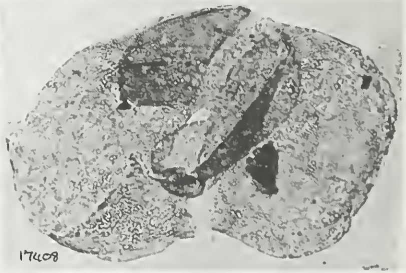

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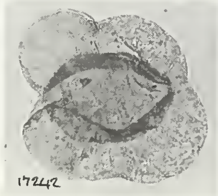

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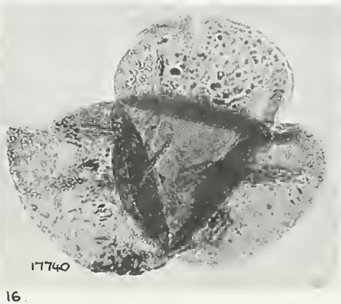

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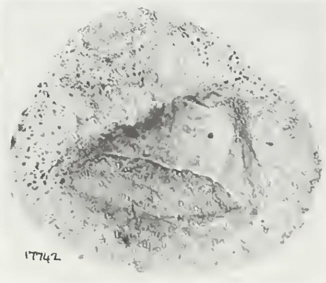
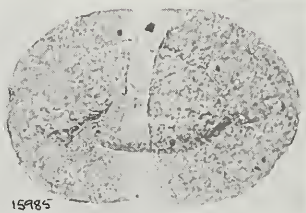


17.

Pityosporites amplus (Balme + Henn. '55) comb. nov.

● HKr.



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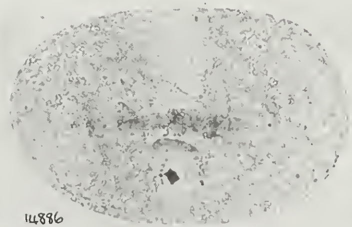

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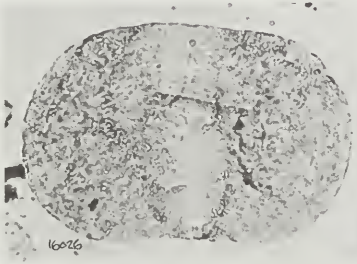

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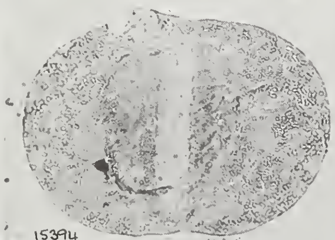

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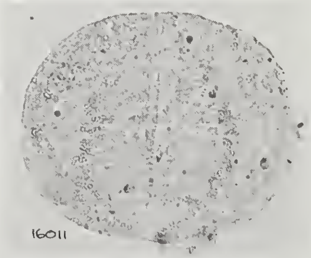

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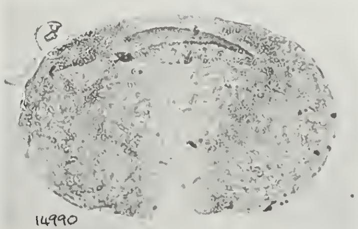

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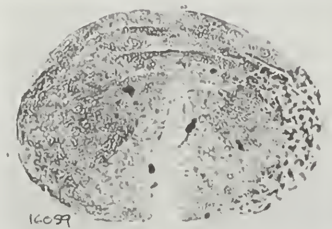

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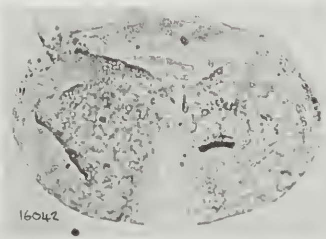

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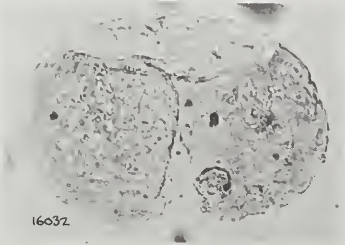

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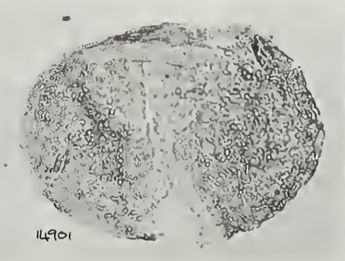

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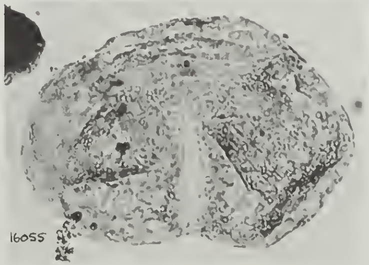

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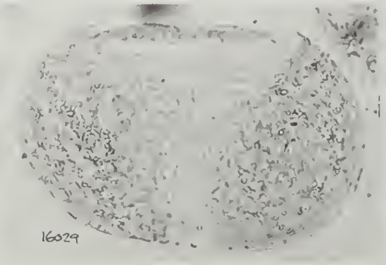

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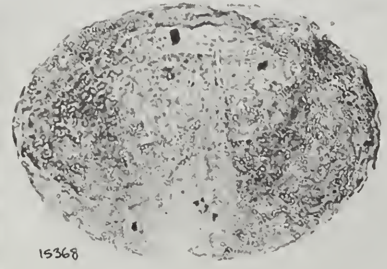
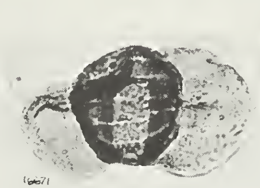


13.

Pityosporites amplus (Balme+Henn.'55) comb.nov.

o Kb.



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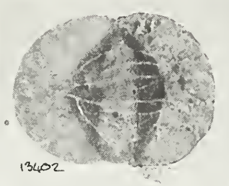

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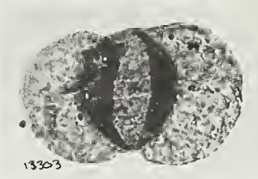

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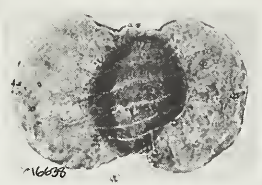

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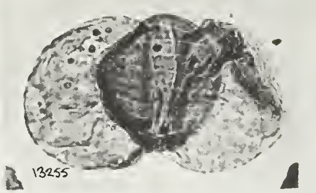

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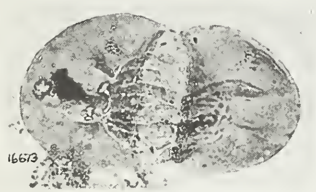

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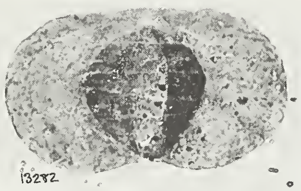

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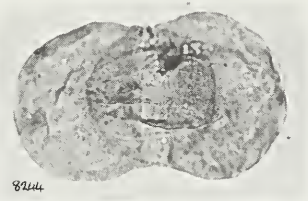

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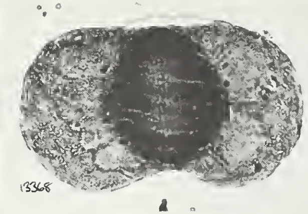

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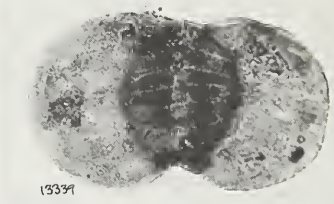

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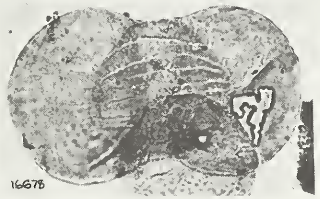

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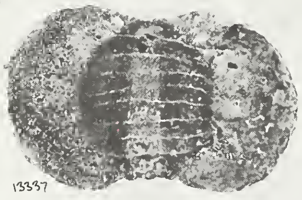

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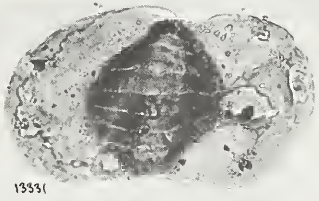

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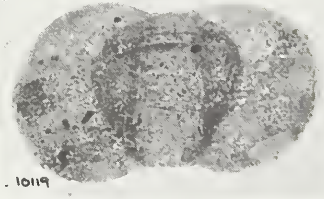

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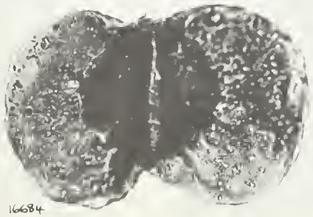

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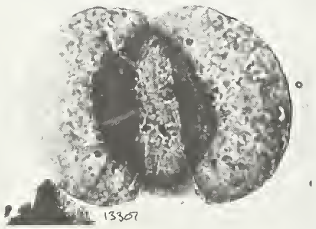

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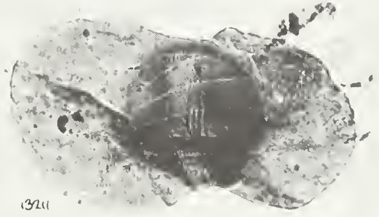

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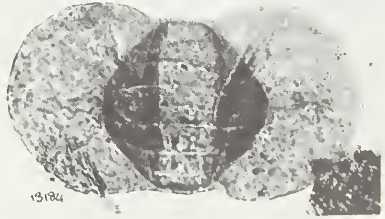

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Pityosporites amplus (Balme + Henn. '55) comb. nov.

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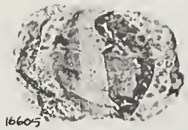
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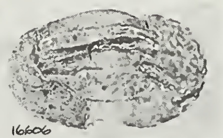
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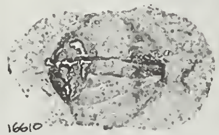
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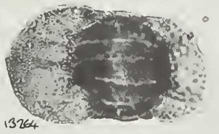
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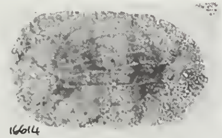
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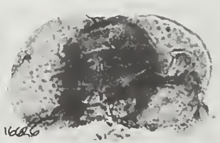
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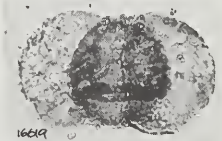
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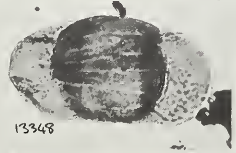
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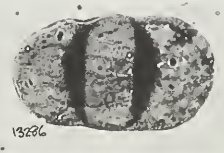
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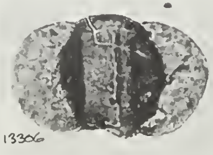
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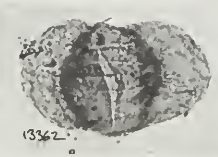
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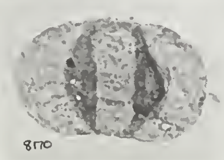
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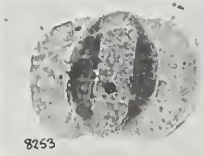
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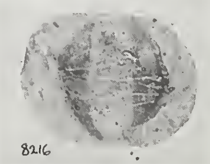
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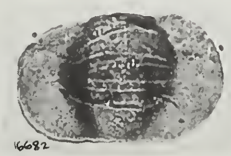
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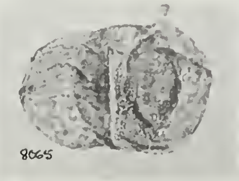
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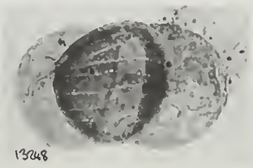
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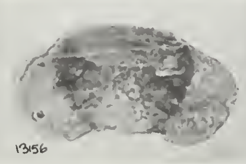
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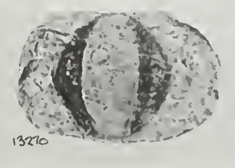
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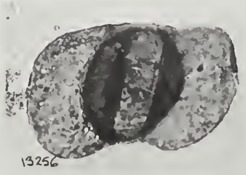
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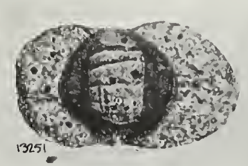
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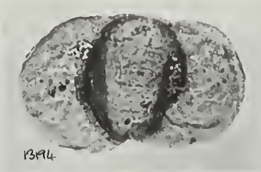
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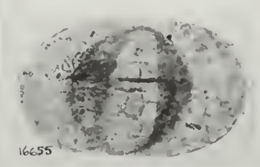
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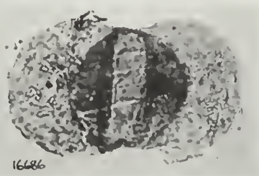
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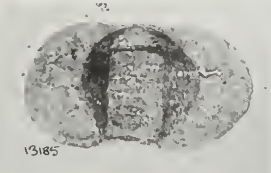
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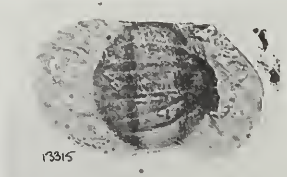
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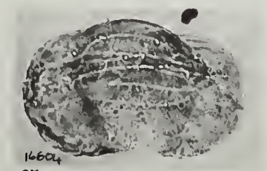
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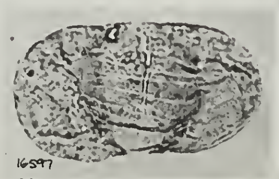
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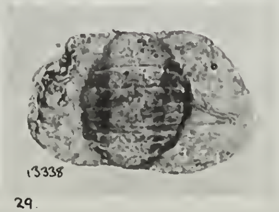
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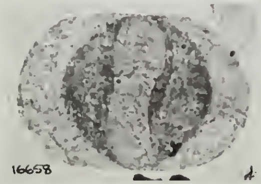
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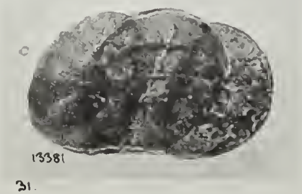
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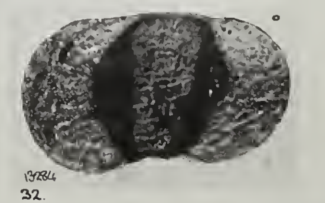
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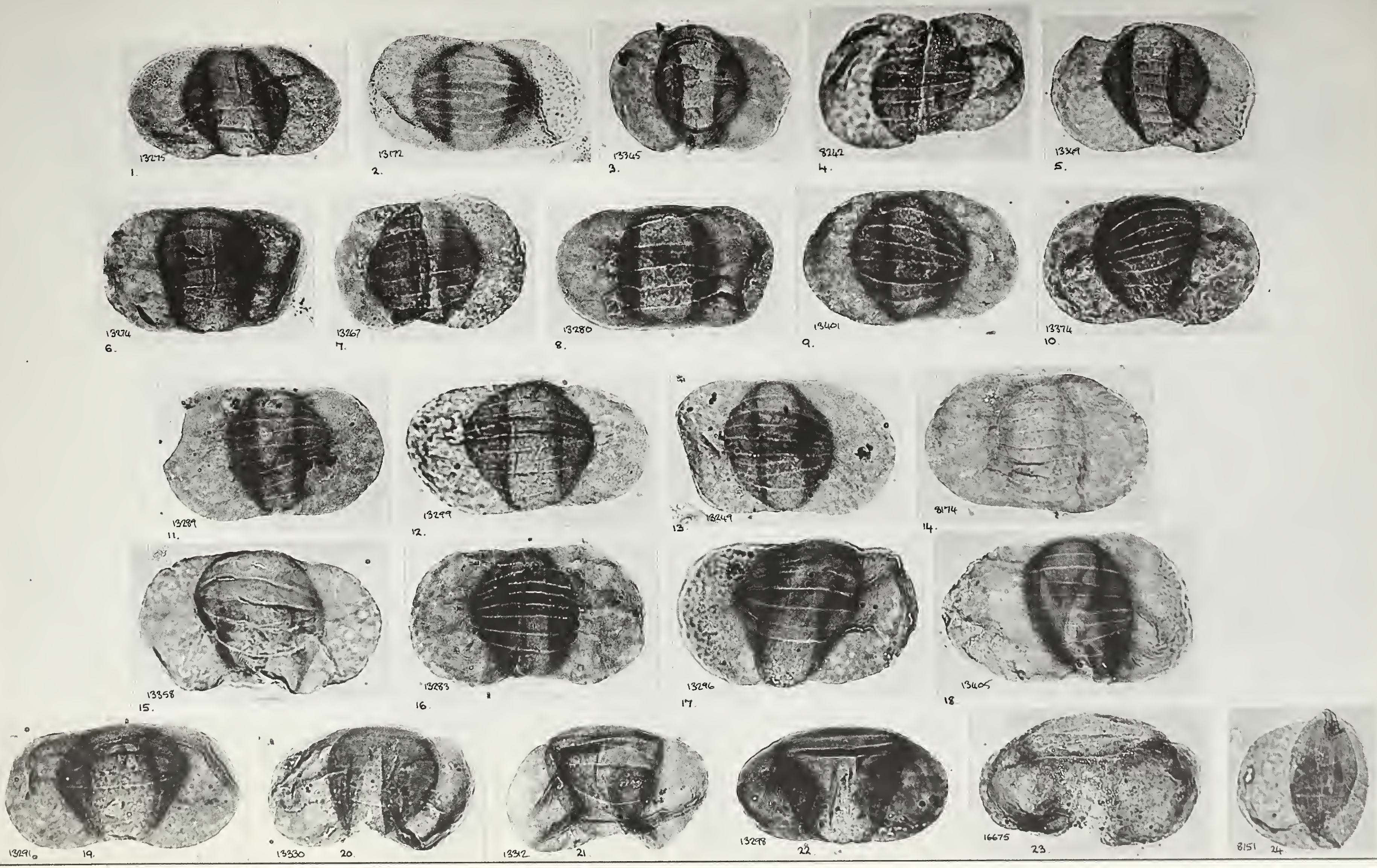
Pityosporites amplus (Balme + Henn. '55) comb. nov.

o Kb.



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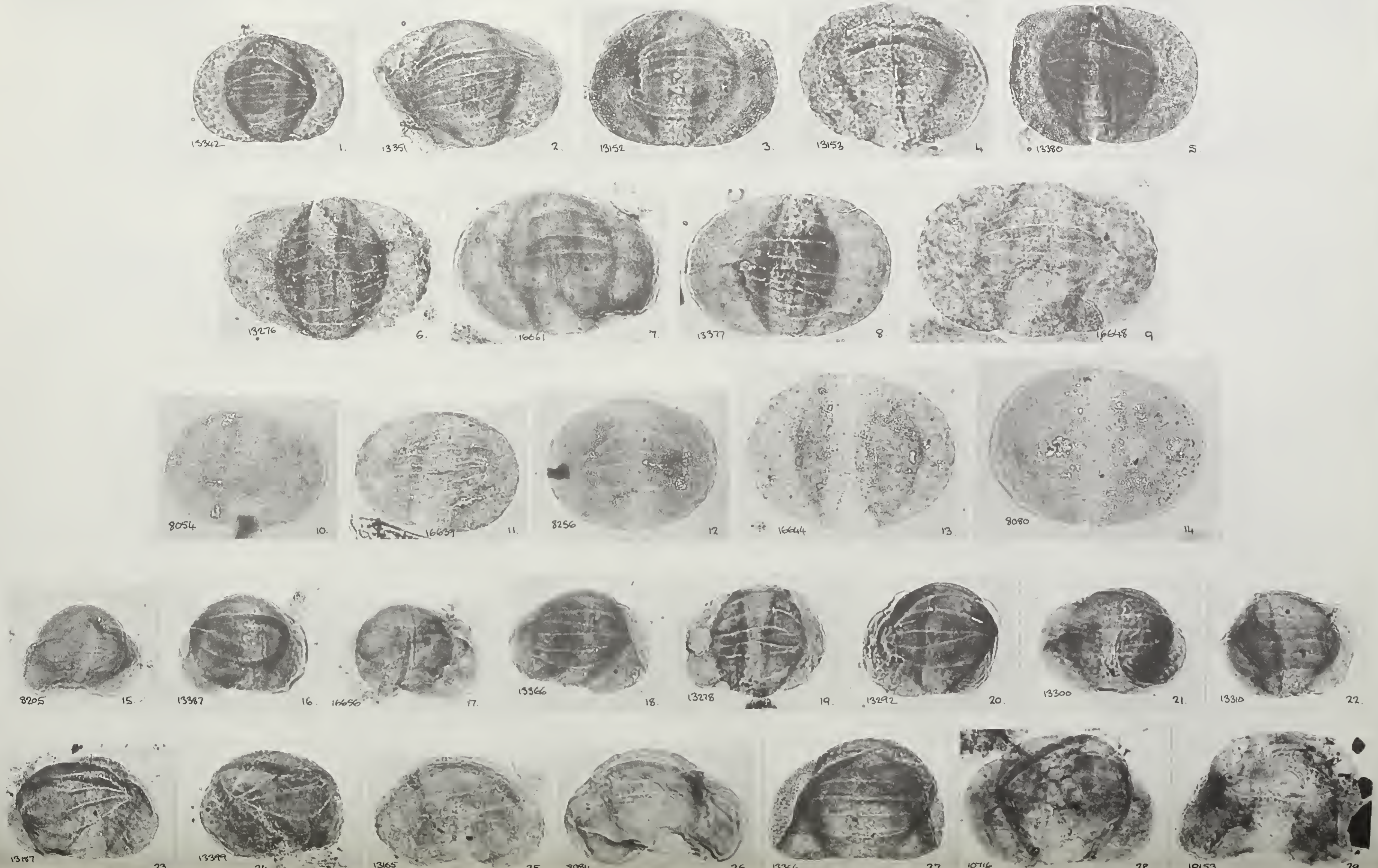
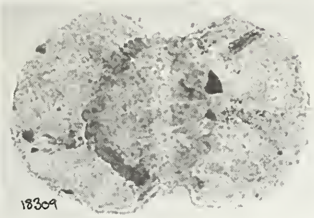


Pityosporites amplus (Balme + Henn '55) comb.nov.

o OW 1145'



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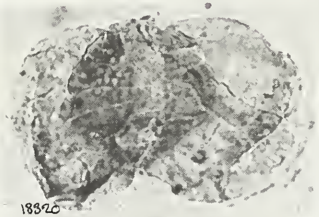

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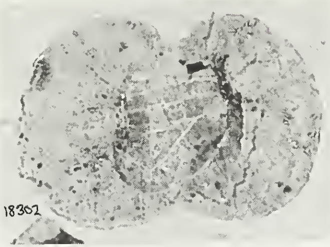

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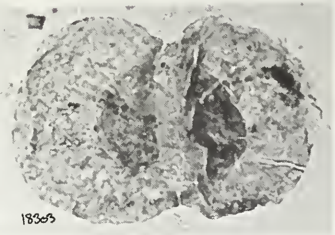

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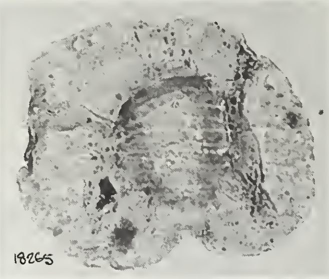

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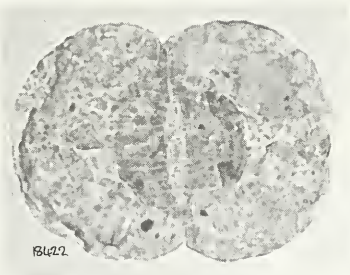

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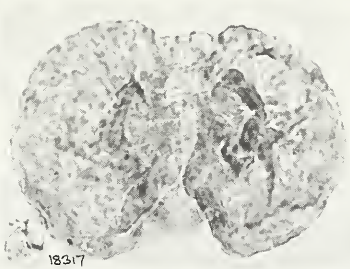

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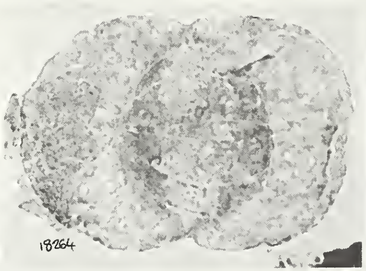

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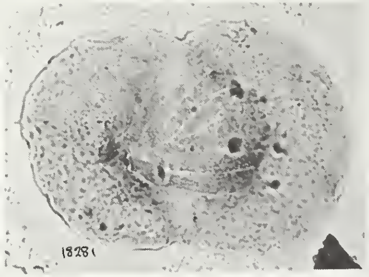

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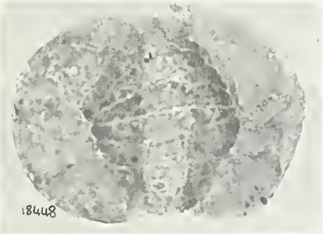

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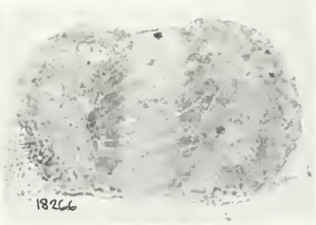

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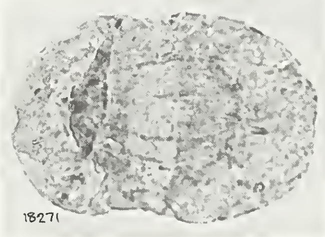

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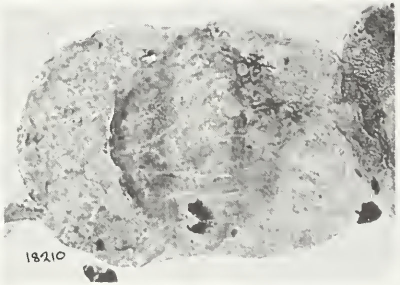

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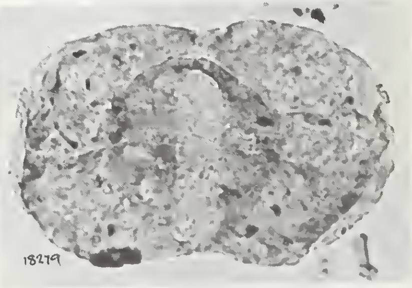
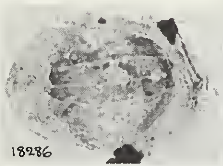


14.

Pityosporites amplus (Balme & Henn. '55) comb nov.

o OW 1145'



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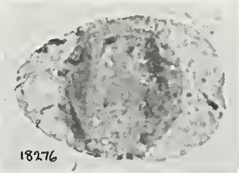

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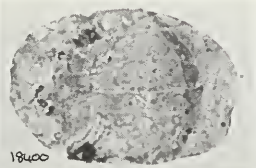

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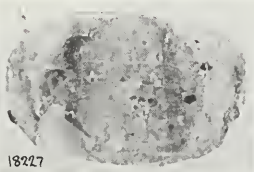

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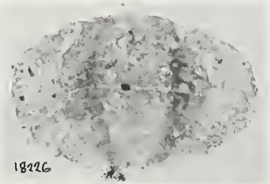

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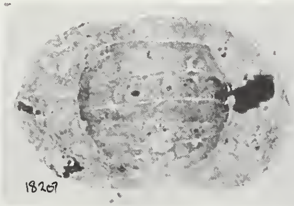

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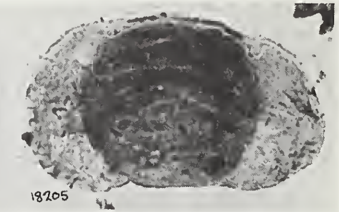

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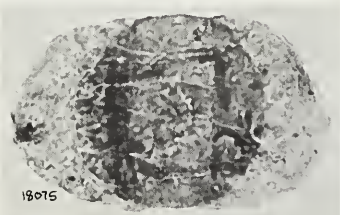

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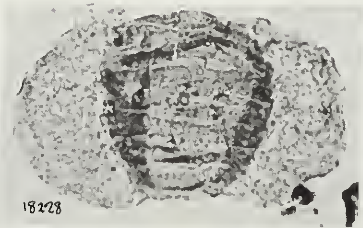

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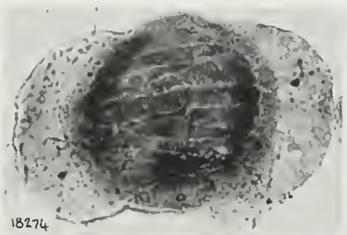

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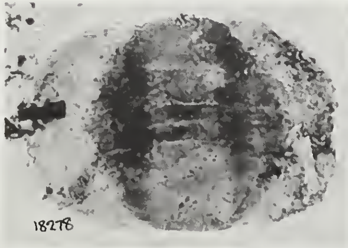

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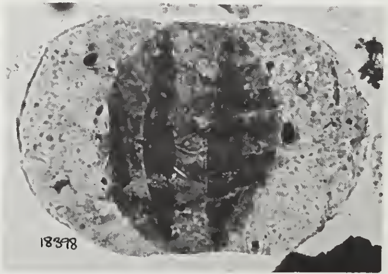

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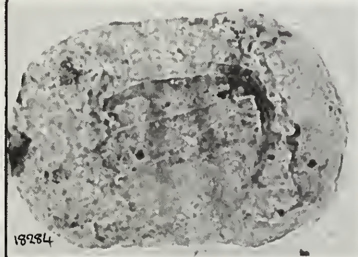

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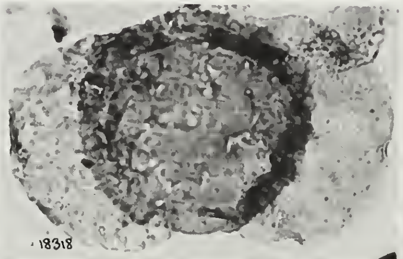

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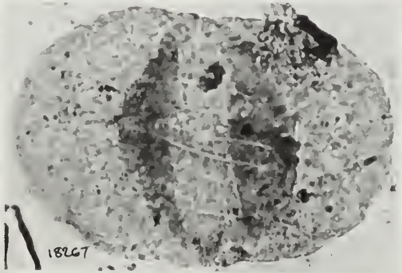

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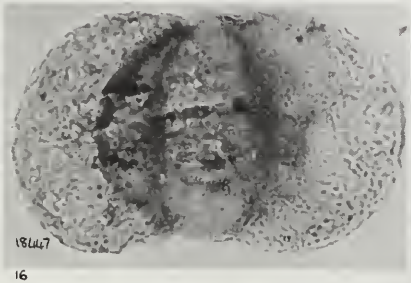

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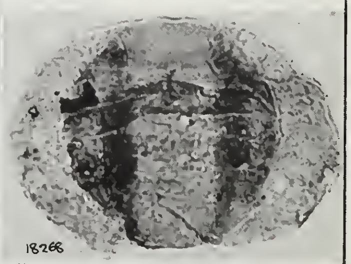

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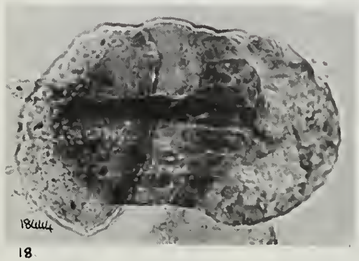

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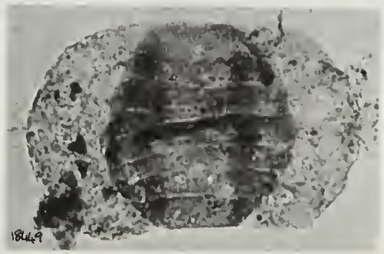

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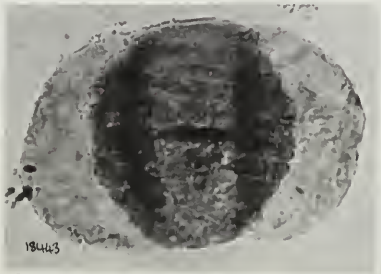

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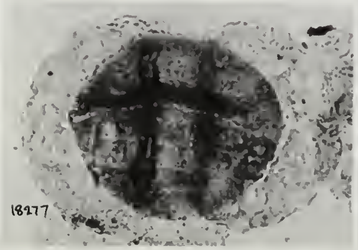

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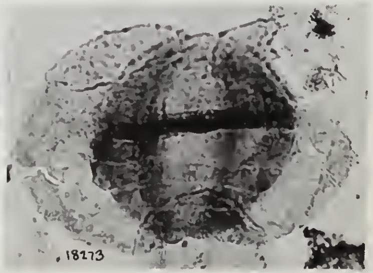
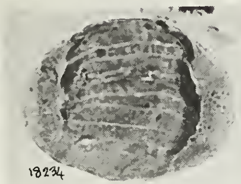


22.

Pityosporites amplus (Balme & Henn. '55) comb. nov.

0 OW 1145'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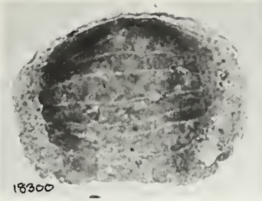
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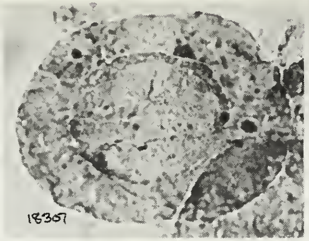
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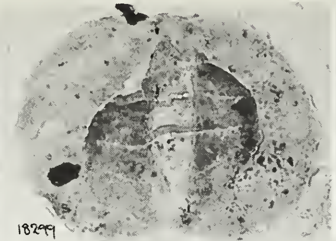
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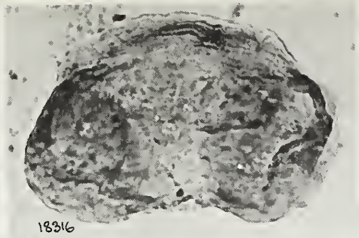
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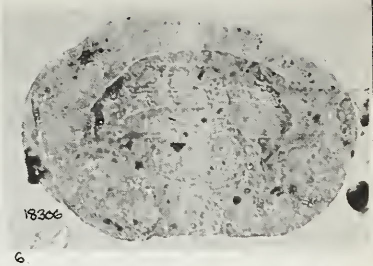
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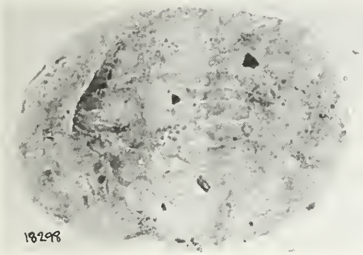
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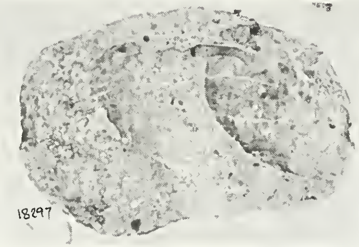
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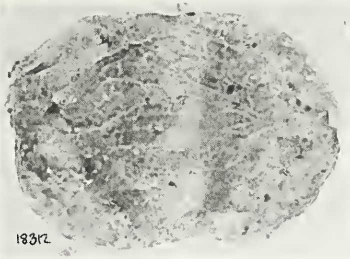
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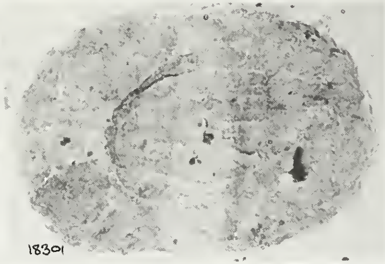
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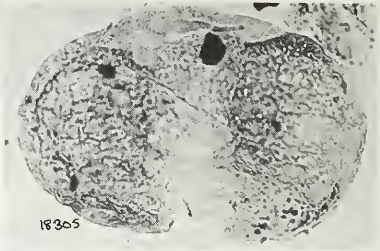
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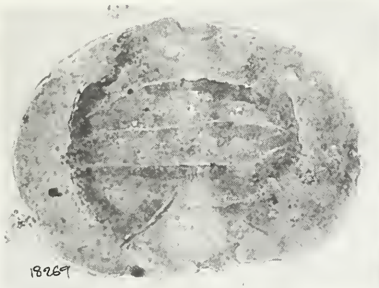
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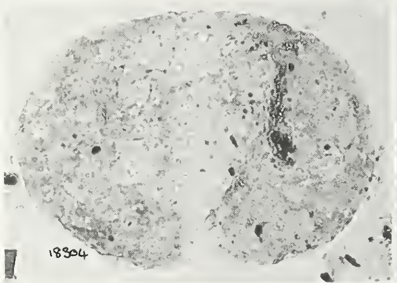
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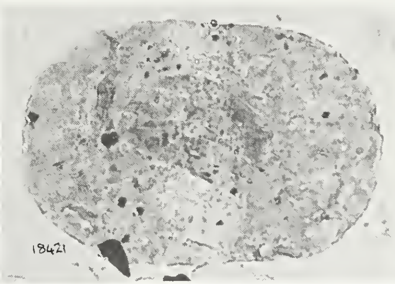
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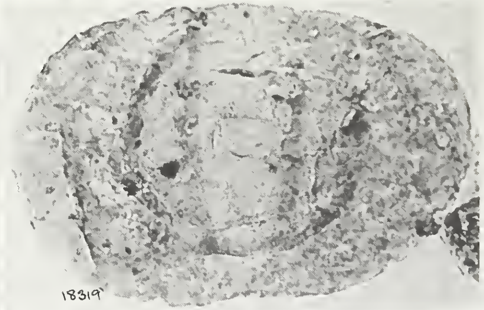
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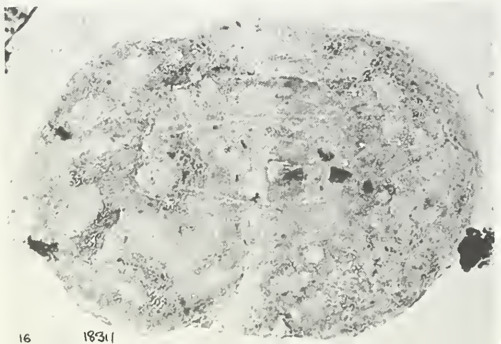
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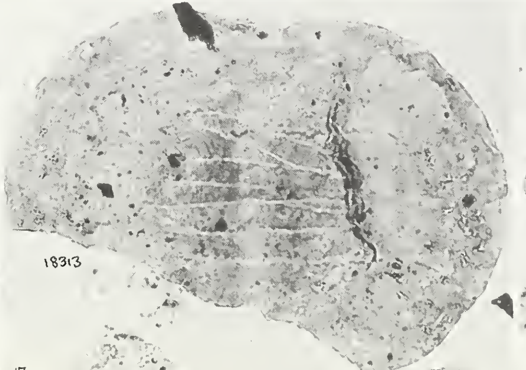
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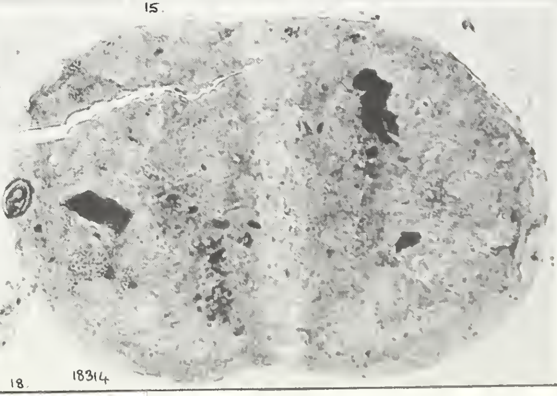
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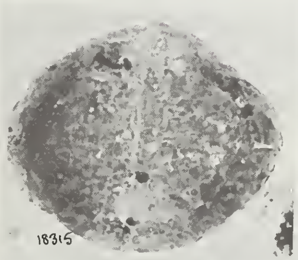
Pityosporites amplus (Balme & Henn.'55) comb.nov.

0 OW 1145'



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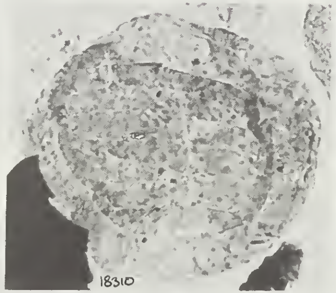

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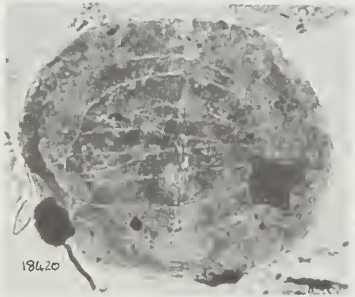

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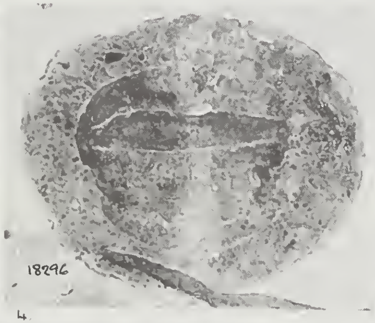

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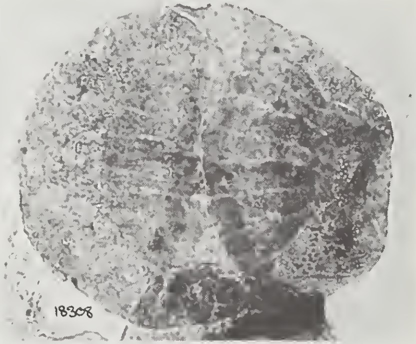

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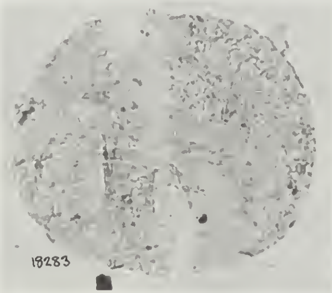

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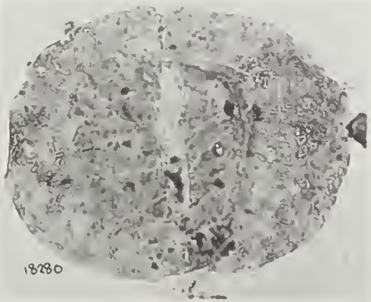

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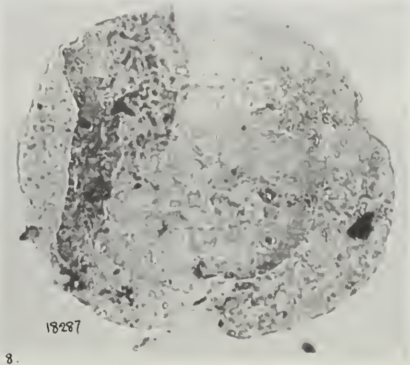

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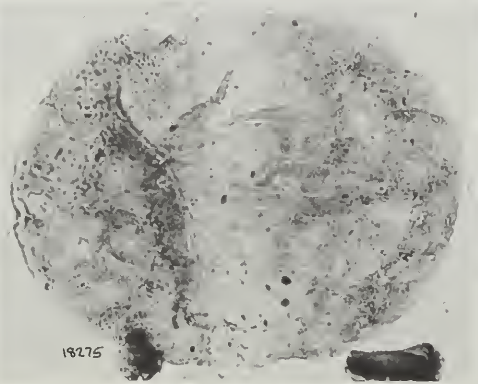

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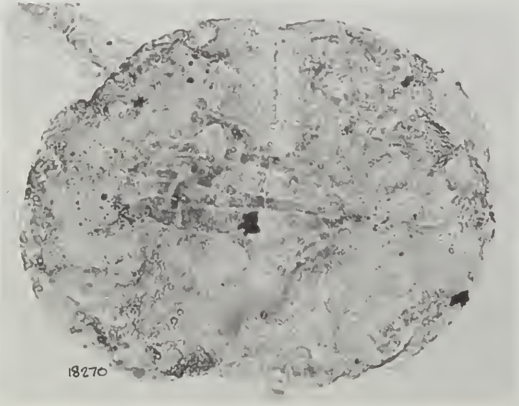
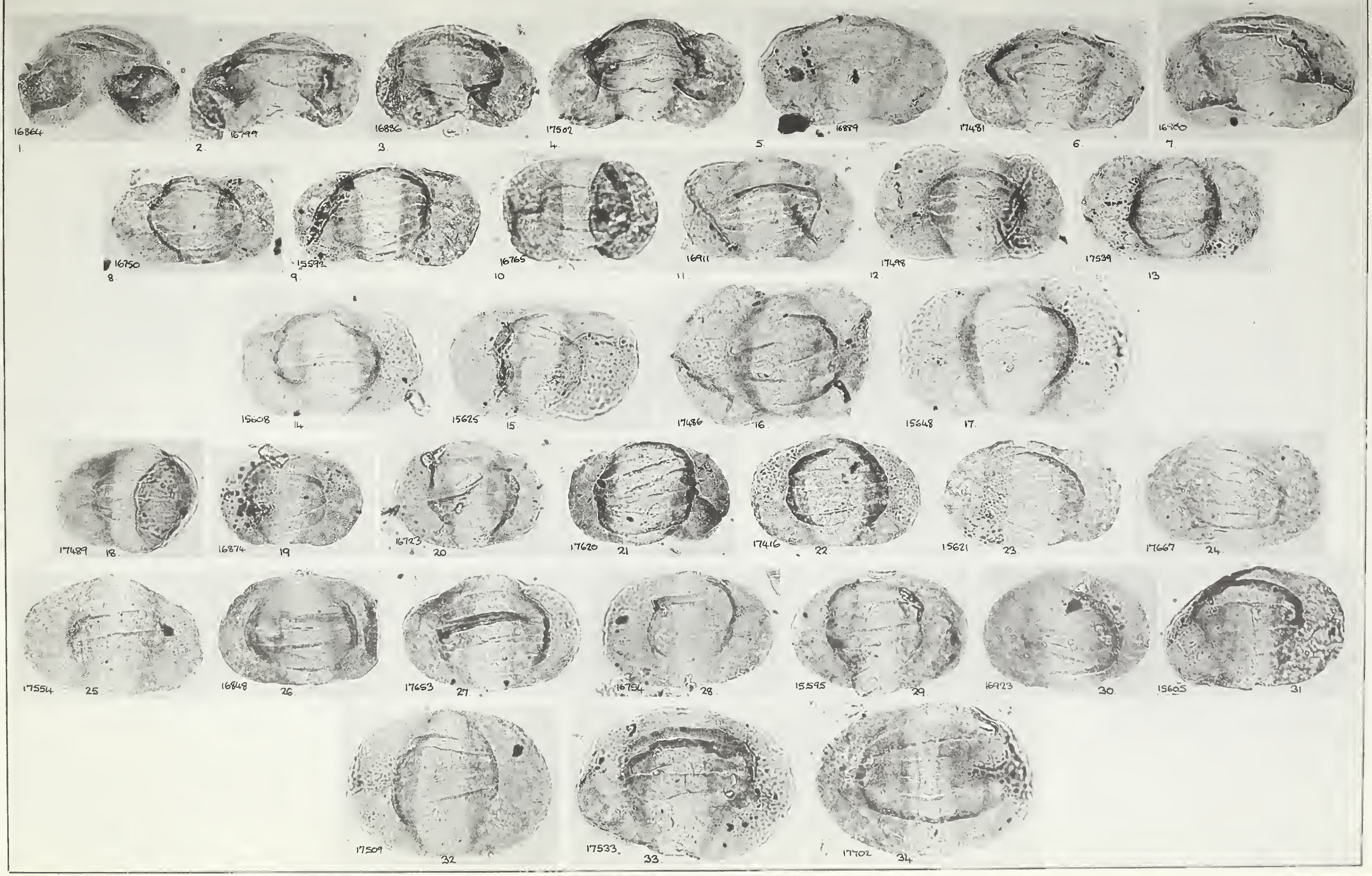


10.

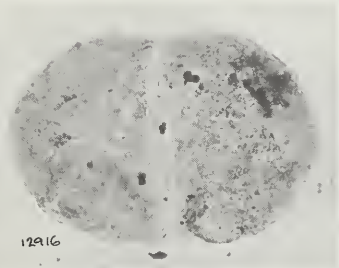
Pityosporites amplus (Balme + Henn.'55) comb. nov.

o OW 94'



Pityosporites amplus (Balme + Henn. '55) comb. nov.

o WV3 133,50



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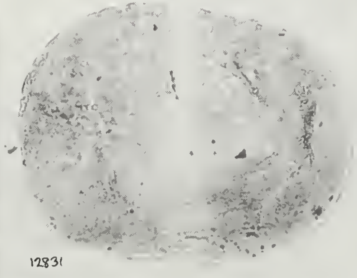

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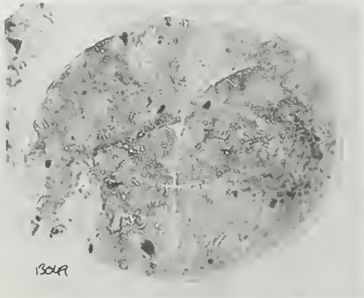

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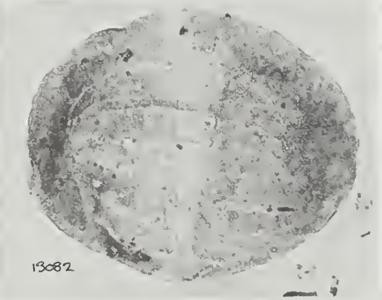

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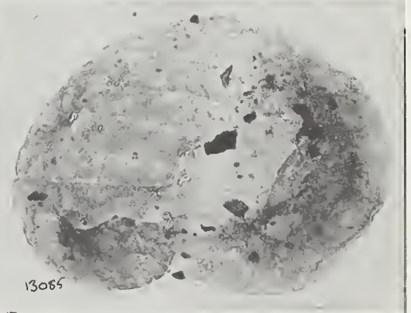

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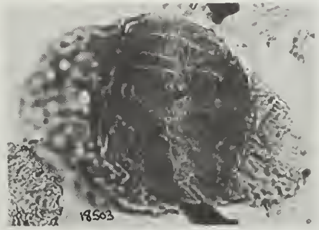
o SAP 6 1152'3", 1152'9"



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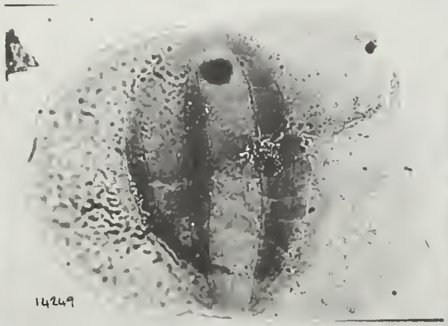

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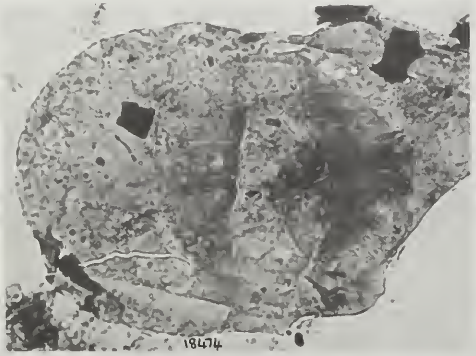

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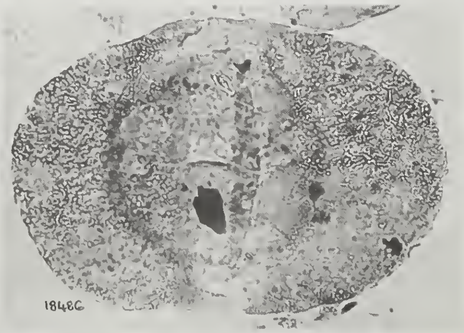

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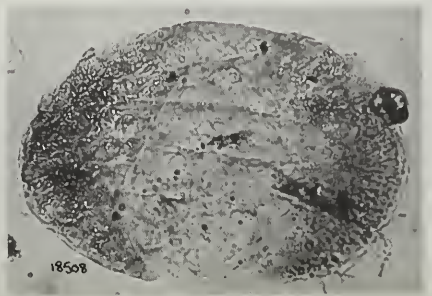

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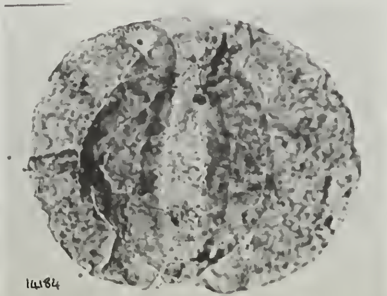

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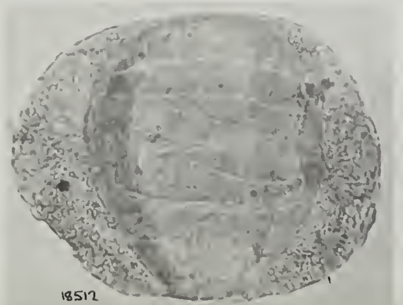

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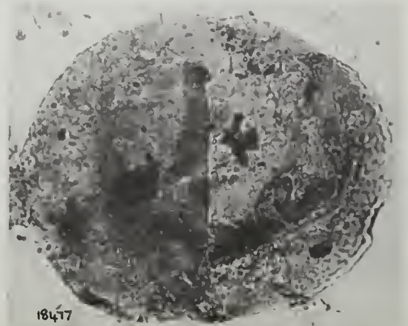
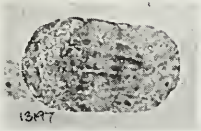


13.

Pityosporites micros (Hart'63) comb.nov.

● Kb.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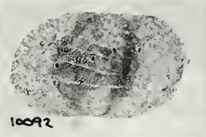
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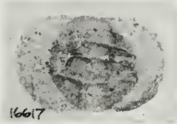
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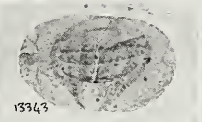
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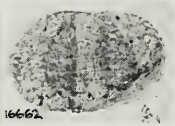
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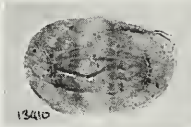
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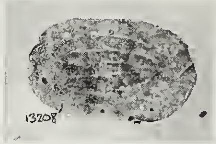
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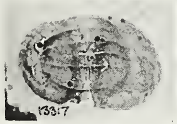
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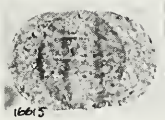
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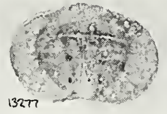
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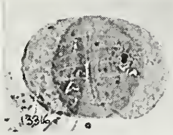
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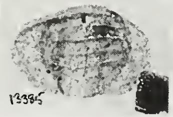
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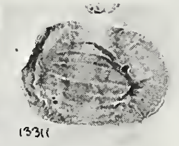
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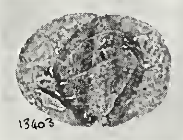
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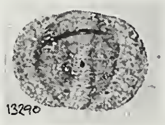
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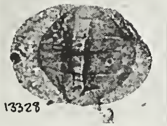
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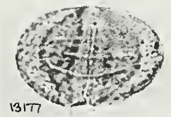
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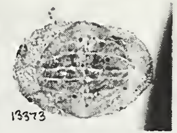
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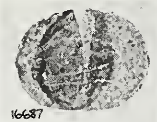
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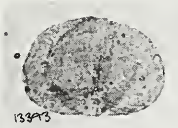
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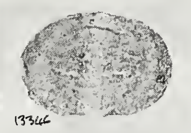
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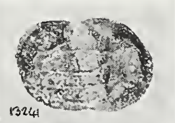
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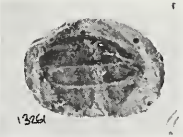
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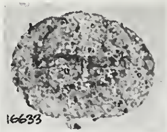
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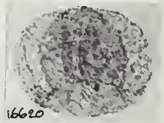
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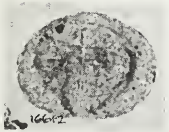
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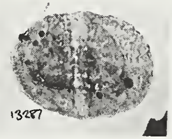
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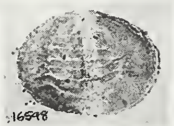
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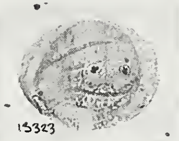
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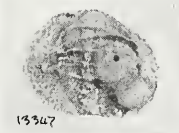
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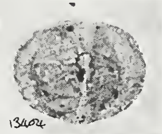
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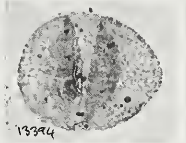
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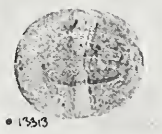
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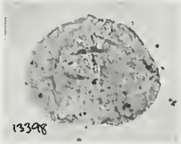
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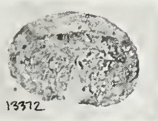
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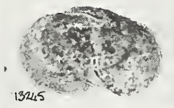
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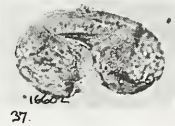
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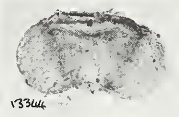
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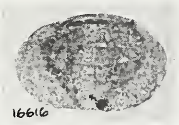
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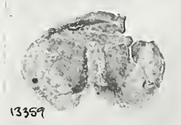
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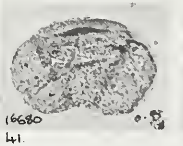
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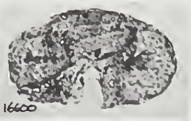
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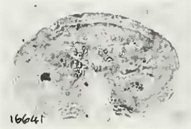
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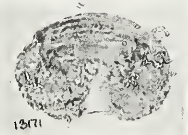
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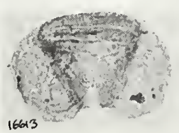
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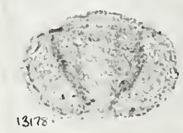
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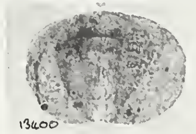
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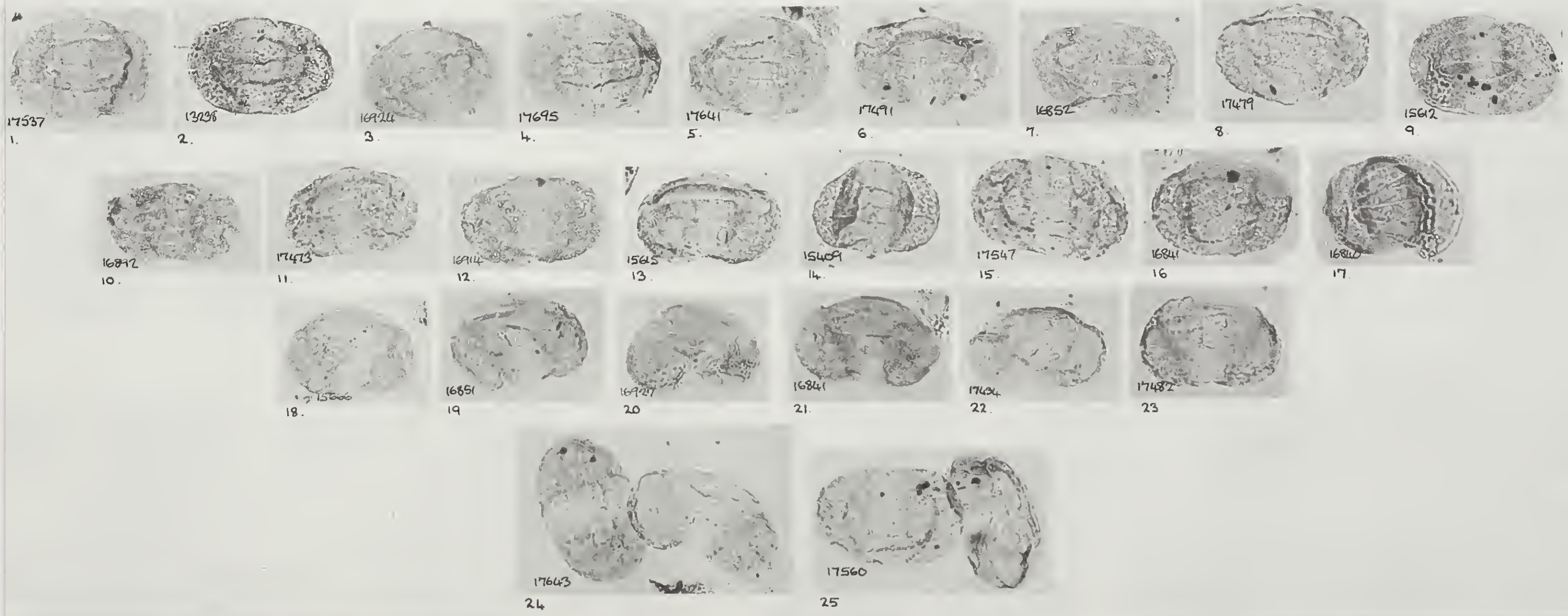
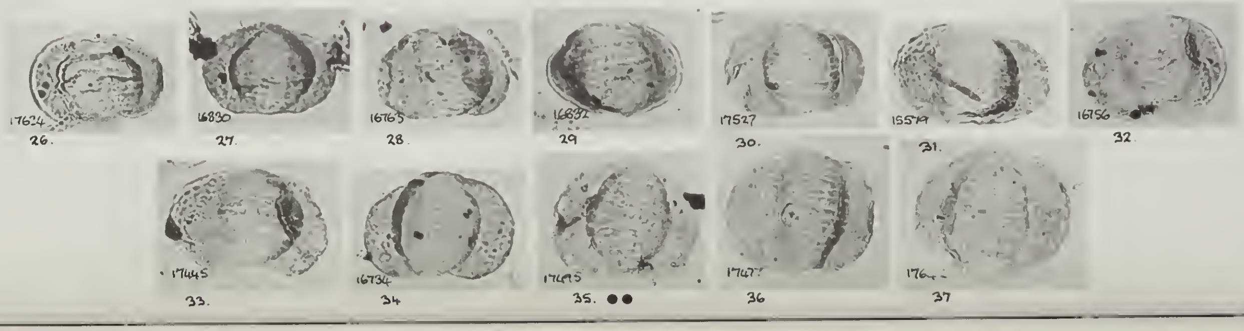
Pityosporites micros (Hart '63) comb. nov.

o OW 94'



Pityosporites varimicros sp. nov.

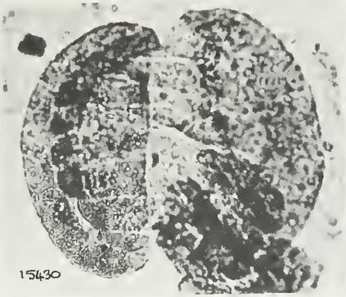
• OW 94'



Lueckisporites asulcus (Bose & Kar '66) comb. nov. / Lueckisporites nyakapendensis Hart '60

pl. 175, 176, 177 (in full) pl. 179 (in full)

OW 94'



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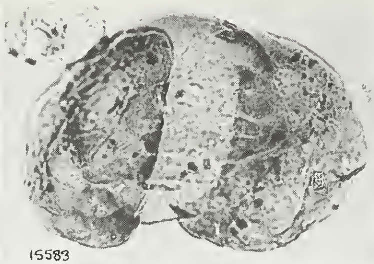

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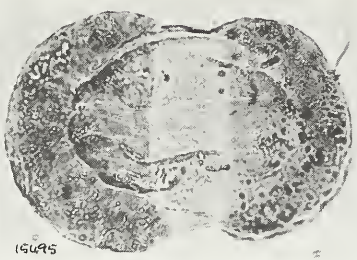

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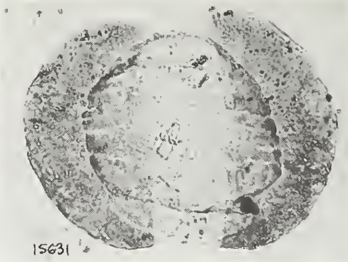

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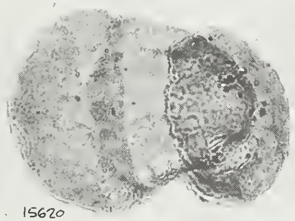

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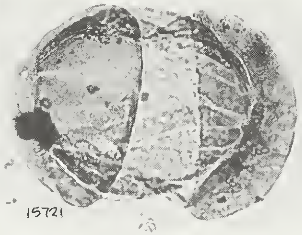

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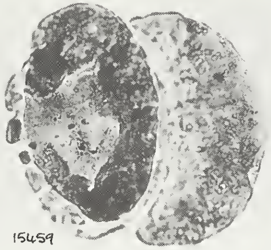

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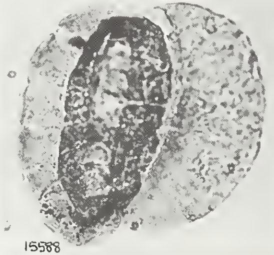

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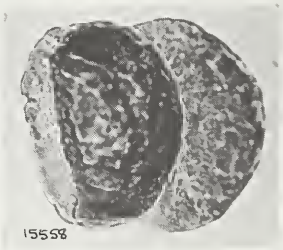
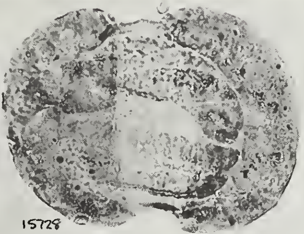


15558

9.

Lueckisporites asulcus (Bose + Kar '66) comb. nov./ Lueckisporites nyakapendensis Hart '60
pl. 175, 176, 177 (in full) pl. 179 (in full)

OW 94'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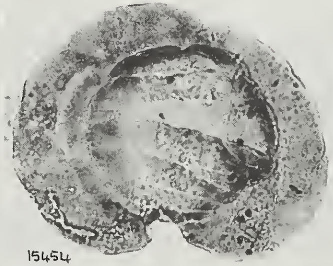
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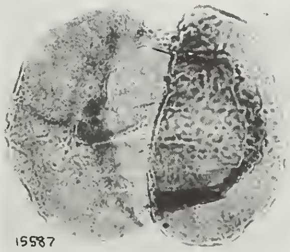
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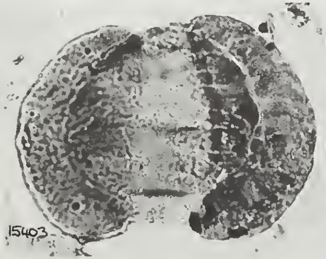
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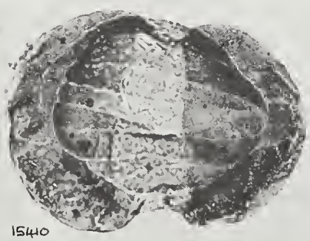
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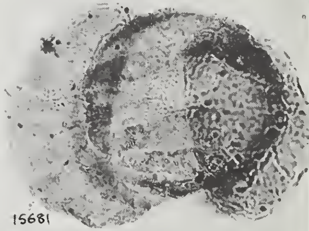
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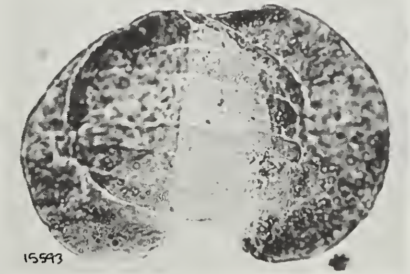
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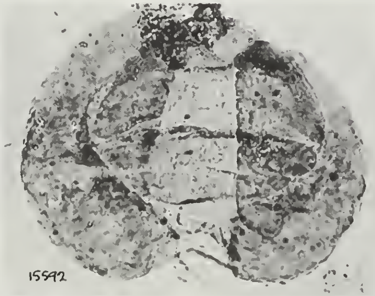
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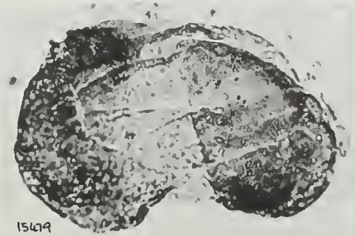
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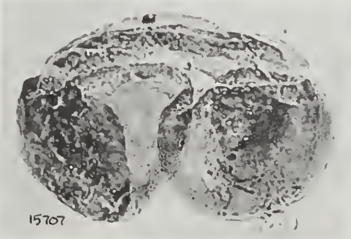
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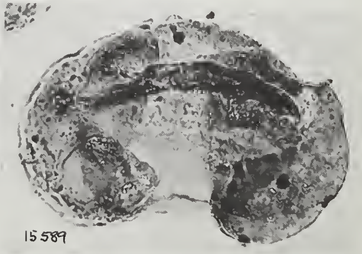
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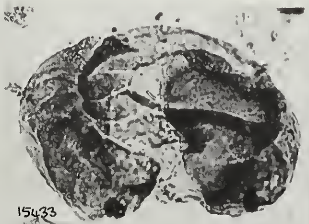
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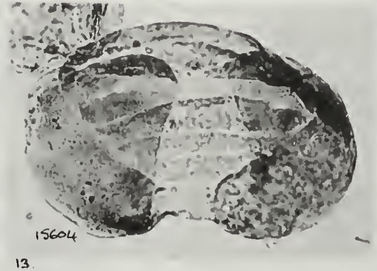
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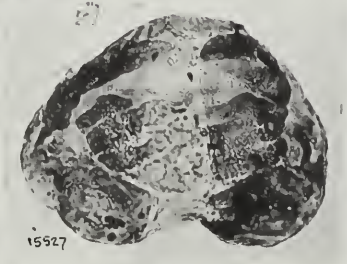
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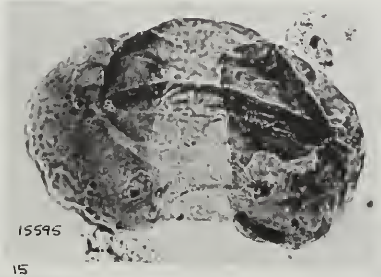
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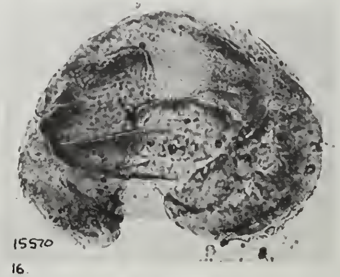
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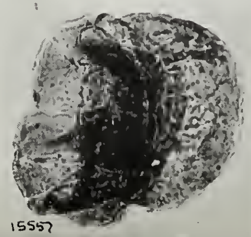
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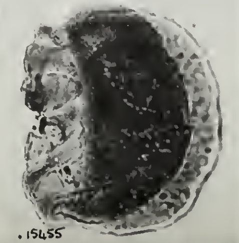
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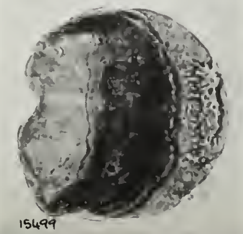
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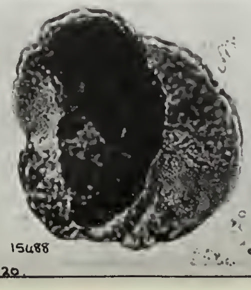
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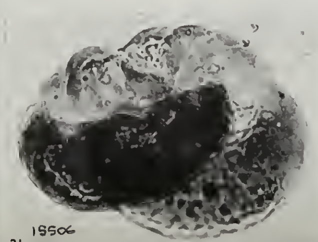
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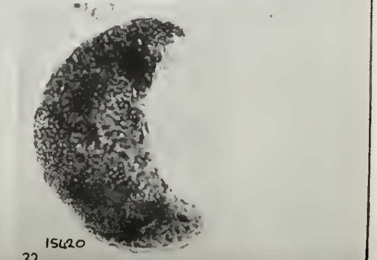
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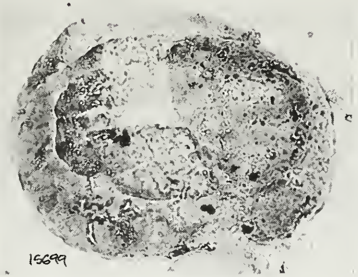
22.

Lueckisporites asulcus (Bose+Kar'66) comb. nov. / Lueckisporites nyakapendensis Hart'60
pl. 175, 176, 177 (in full) pl. 179 (in full)

OW 94'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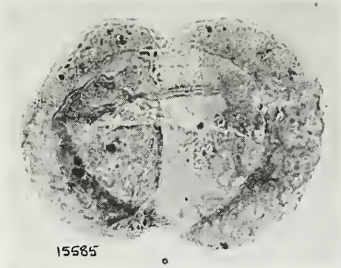
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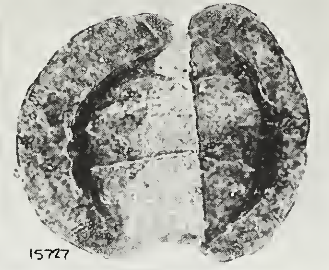
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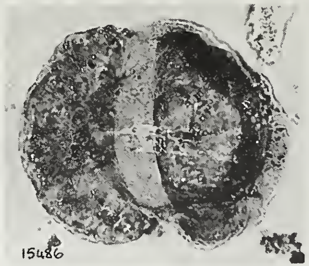
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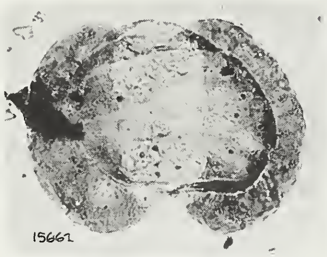
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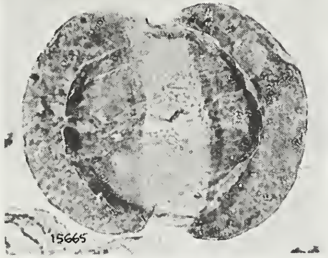
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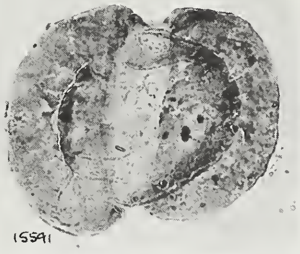
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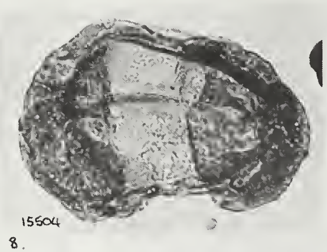
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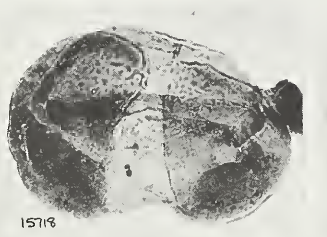
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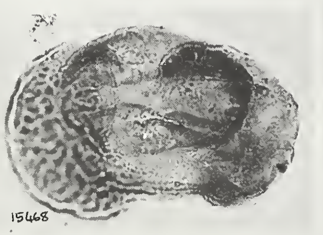
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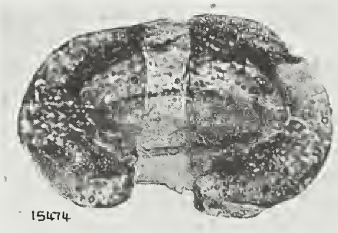
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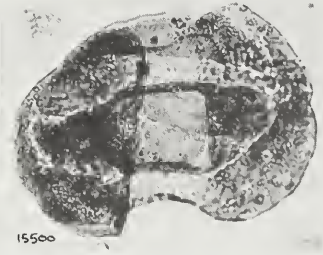
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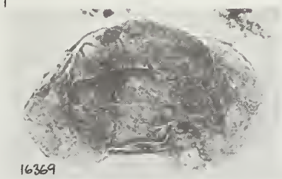
12.

Lueckisporites asulcus (Bose & Kar '66) comb. nov. / Lueckisporites nyakapendensis Hart '60
pl. 178 (1-19) pl. 180 (1-17)

SAP 6 1000', 1007', 1007'6", 1017', 1019'



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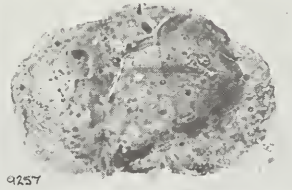

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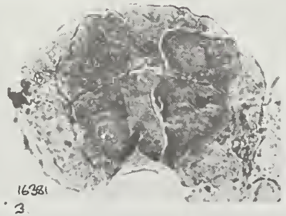

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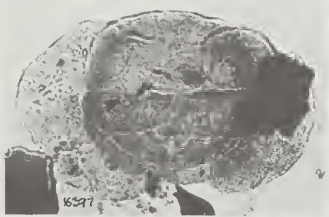

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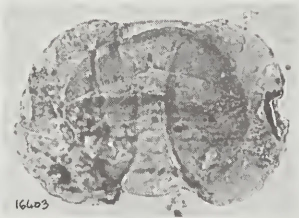

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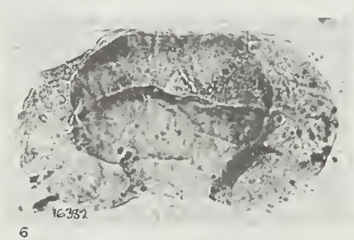

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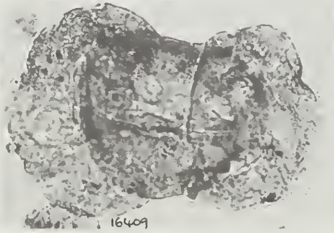

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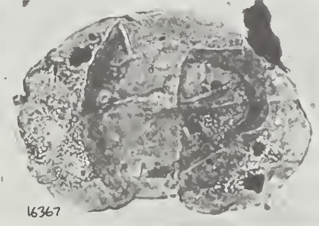

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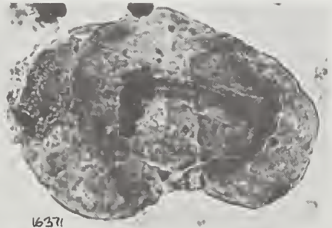

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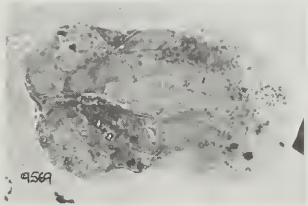

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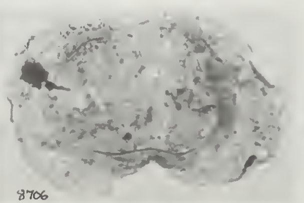

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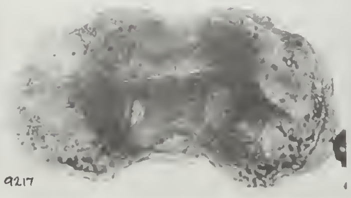

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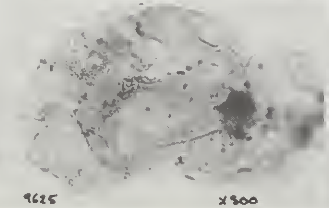

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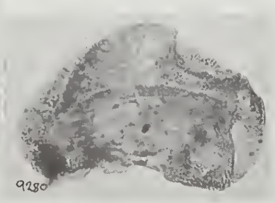

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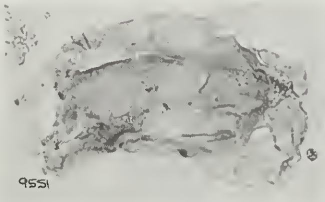

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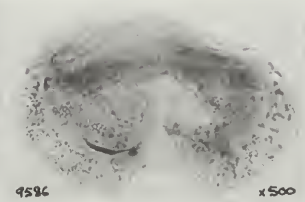

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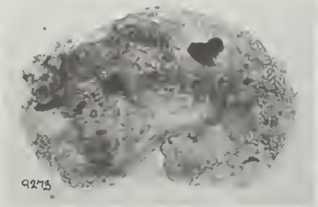

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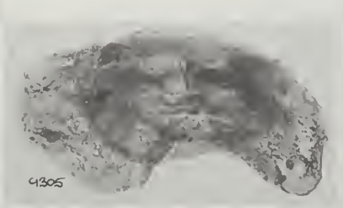

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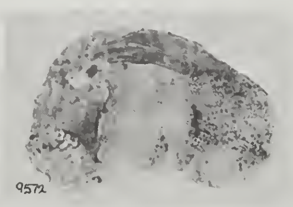
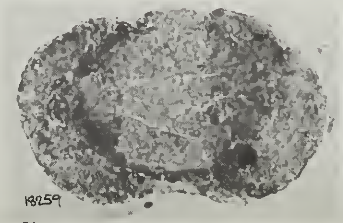


19.

Lueckisporites asulcus (Bose & Kar '66) comb. nov. / Lueckisporites nyakapendensis Hart '60
pl. 178 (20-24) pl. 180 (18-23)

OW 1145'



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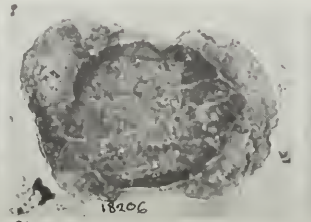

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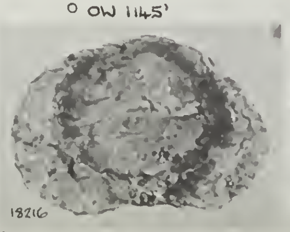

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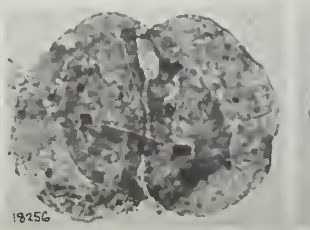

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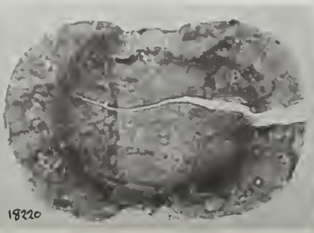
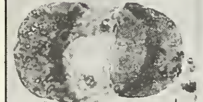


24.

Lueckisporites asulcus (Bose & Kar '66) comb. nov. / Lueckisporites nyakapendensis Hart '60

pl. 175, 176, 177 (in full) pl. 179 (in full)

:OW 94'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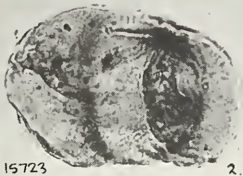
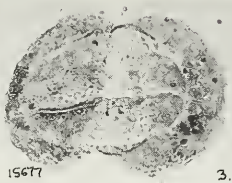

15723 2.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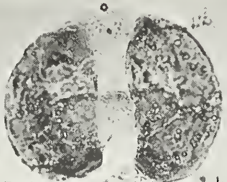
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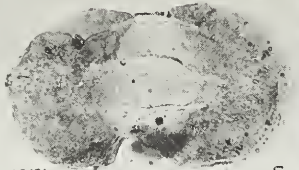
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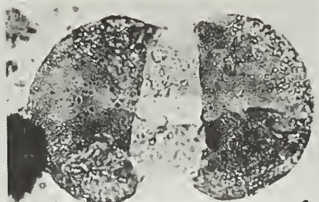
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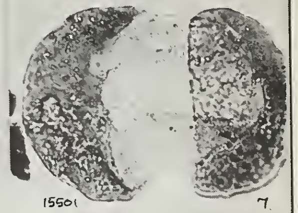
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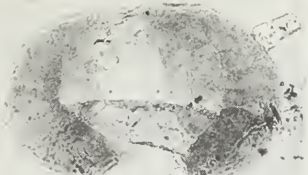
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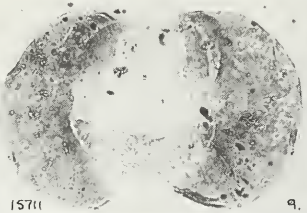
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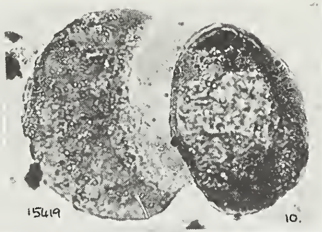
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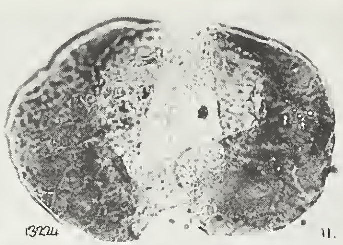
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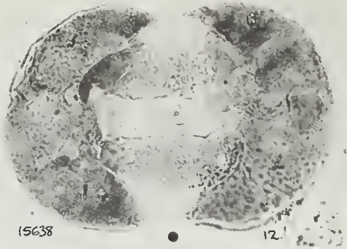
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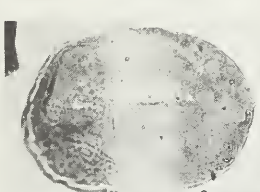
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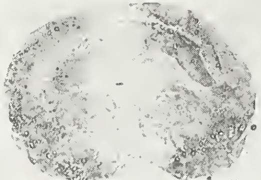
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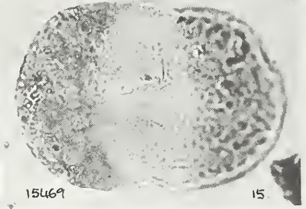
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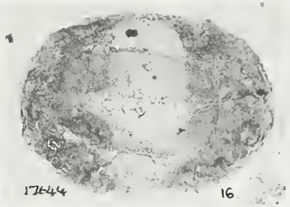
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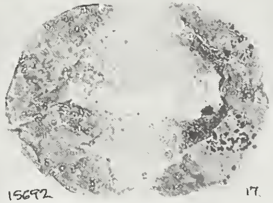
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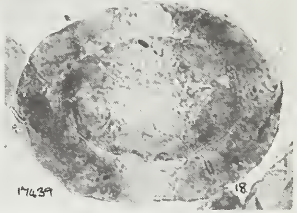
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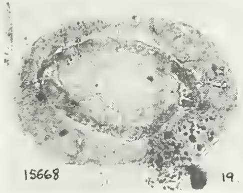
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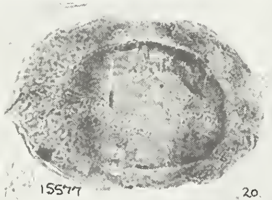
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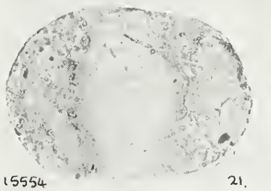
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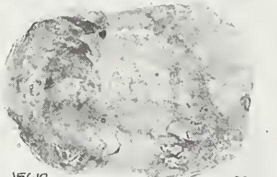
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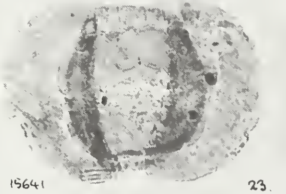
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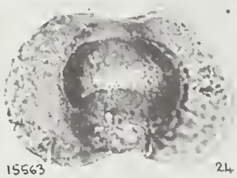
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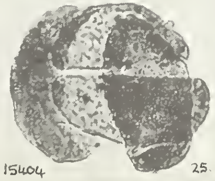
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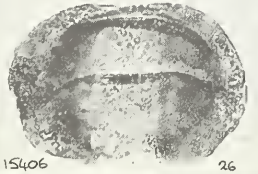
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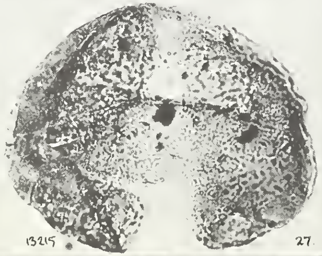
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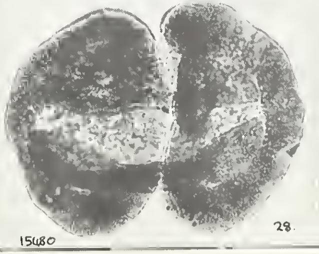
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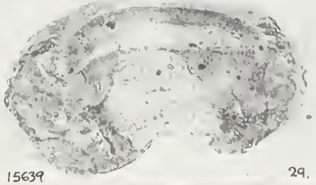
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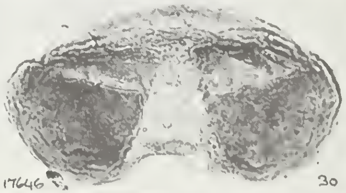
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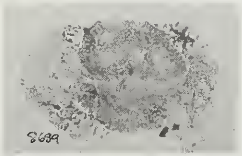
Lueckisporites asulcus (Bose & Kar '66) comb. nov. / Lueckisporites nyakapendensis Hart '60
pl. 178 (1-19) pl. 180 (1-17)

8 SAP 6 1000', 1007', 1007'6", 1017', 1019'



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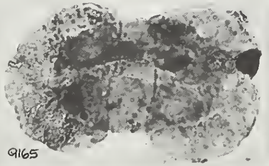

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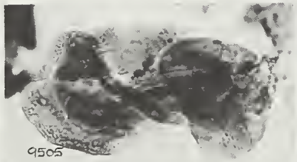

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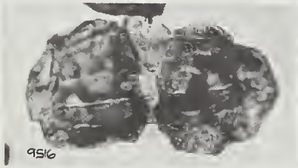

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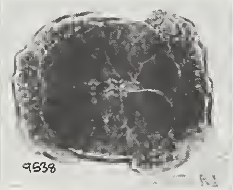

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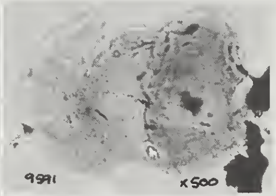

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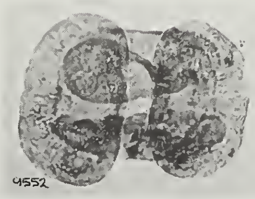

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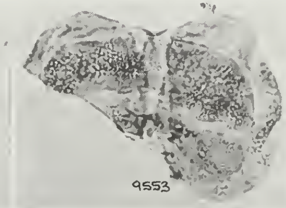

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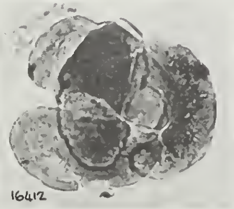

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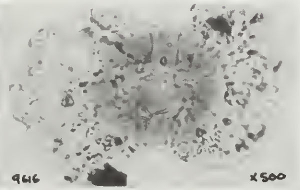

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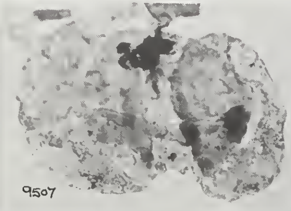

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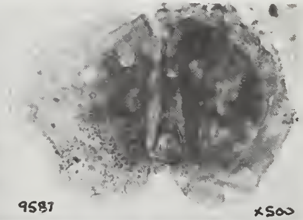

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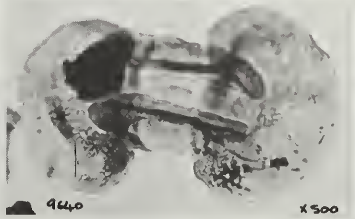

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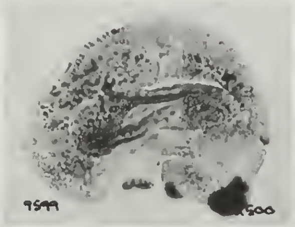

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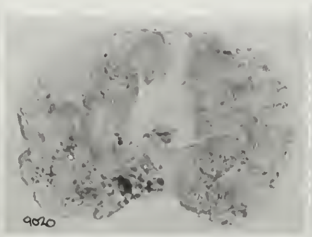

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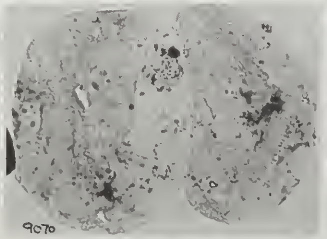

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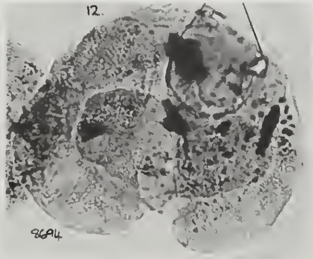
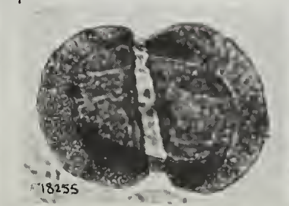


17.

Lueckisporites asulcus (Bose & Kar '66) comb. nov. / Lueckisporites nyakapendensis Hart '60
pl. 178 (20-24) pl. 180 (18-23)

8 OW 1145'



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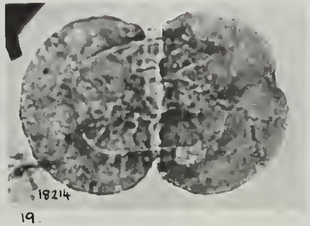

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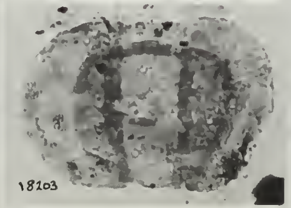

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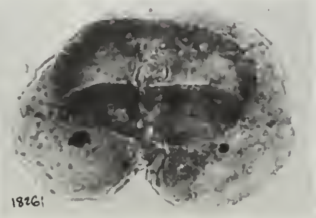

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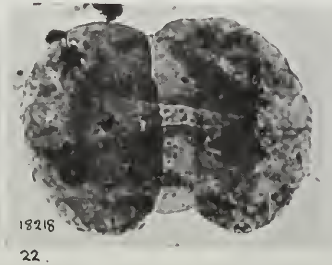

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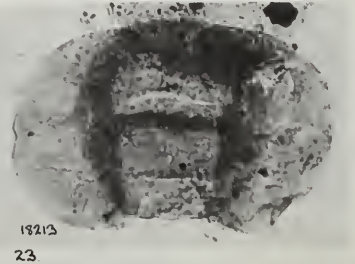
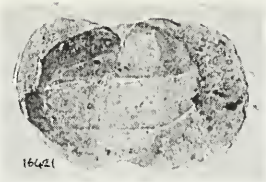


23.

Lueckisporites nyakapendensis Hart '60

o UC 678 79,0 , 80,6



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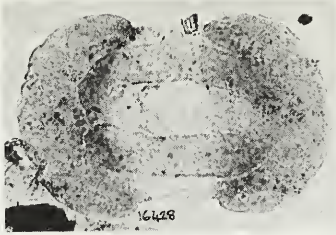

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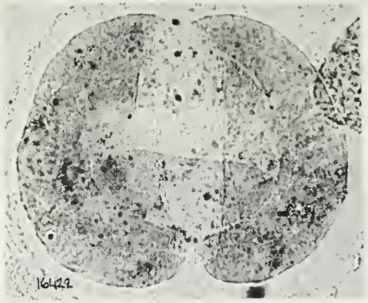

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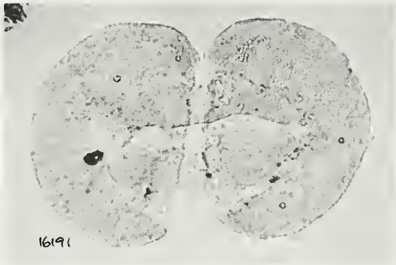

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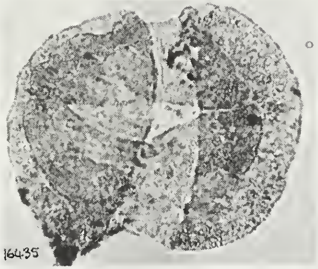

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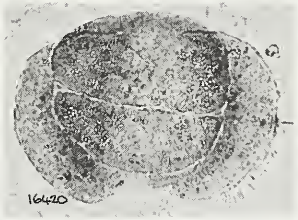

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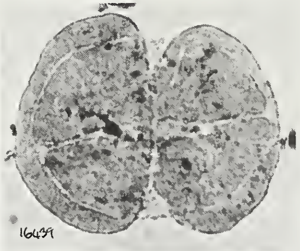
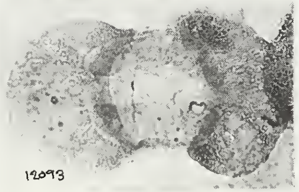


7.

o UC 621 153'



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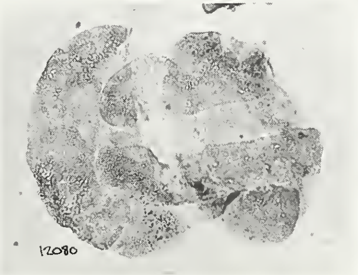

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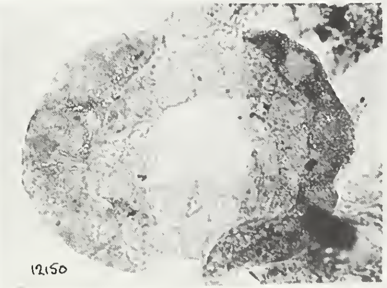
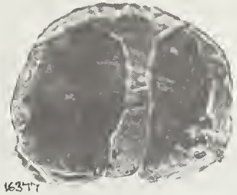


10.

Lueckisporites welkomensis sp.nov.

● SAP 6 1007'6", 1017'



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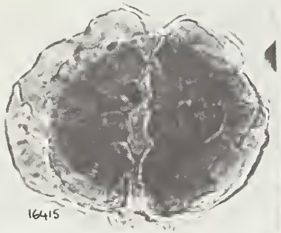

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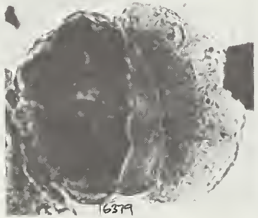

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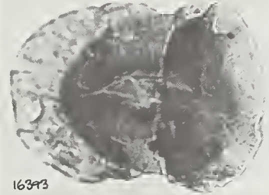

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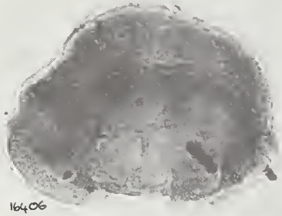

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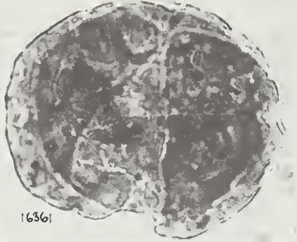

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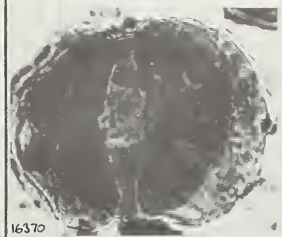

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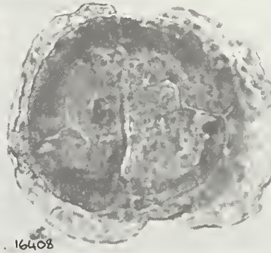

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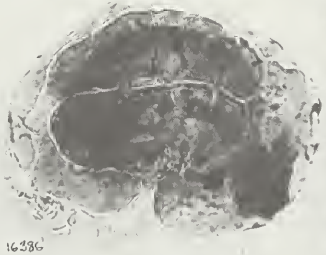

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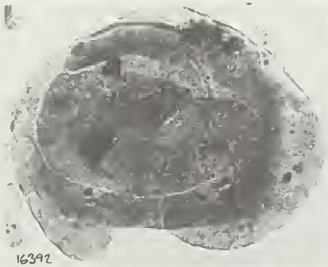

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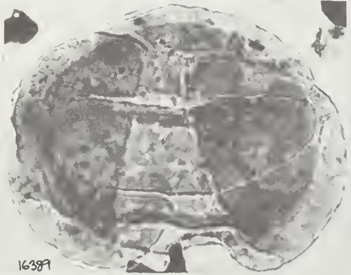

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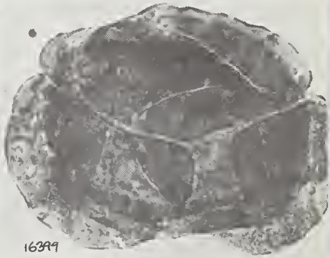

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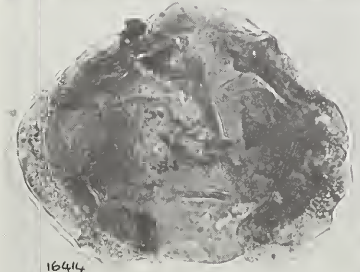

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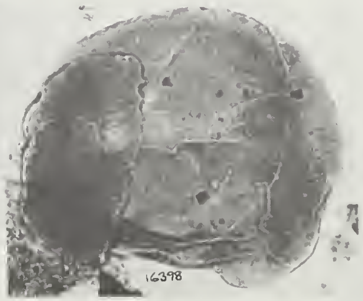

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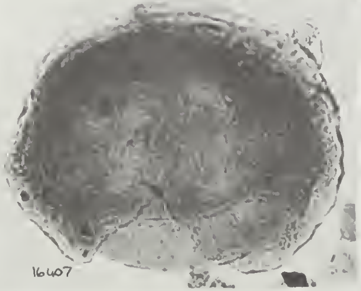

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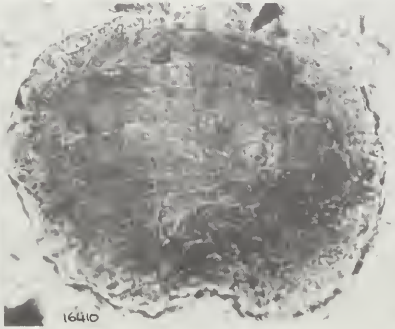

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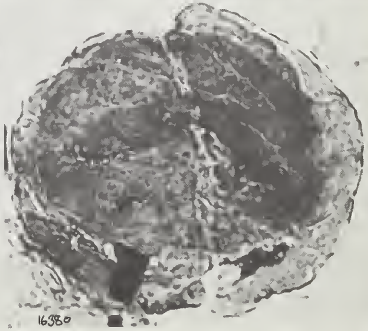

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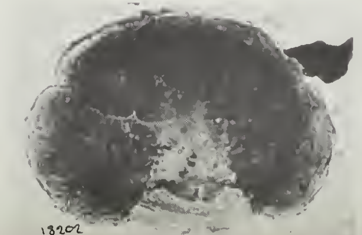
○ OW 1145'



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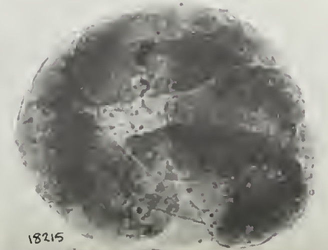

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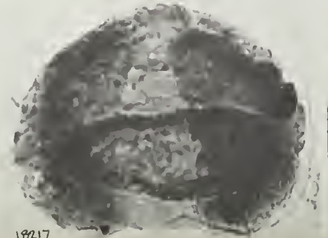

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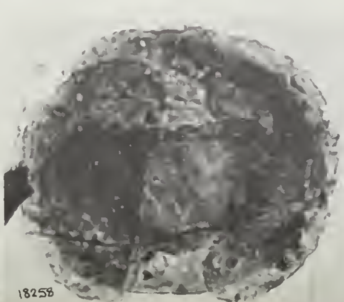

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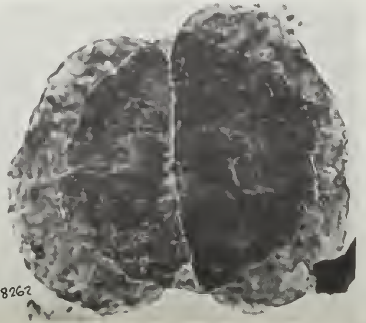
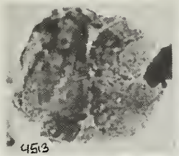


22.

Lueckisporites hannonicus (Goub.'65) comb. nov.

● SAP 6 1000', 1007', 1007'6", 1017', 1019'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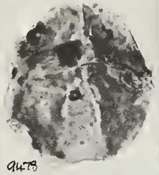
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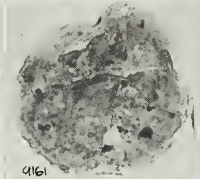
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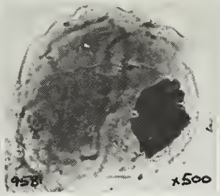
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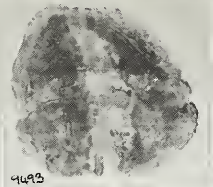
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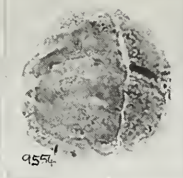
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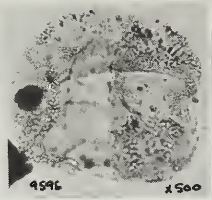
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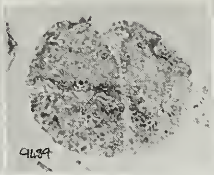
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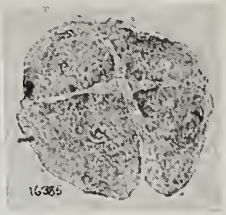
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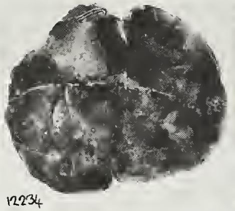
○ UC 678 30,6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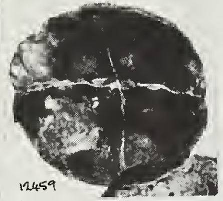
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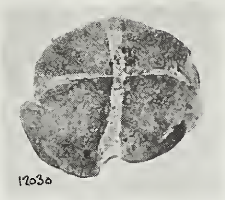
○ UC 621 153'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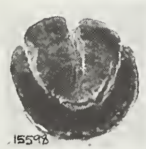
Lueckisporites neohannonicus sp. nov.

● OW 94'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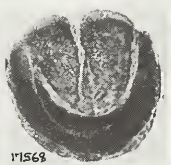
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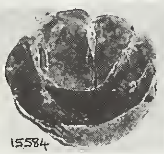
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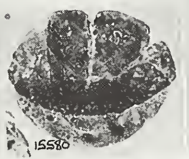
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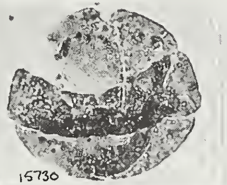
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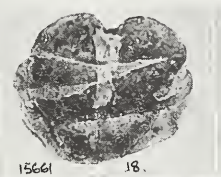
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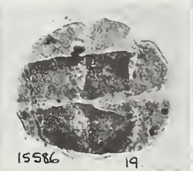
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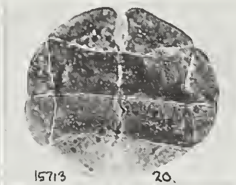
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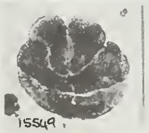
●●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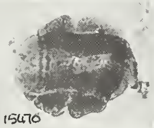
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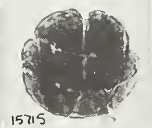
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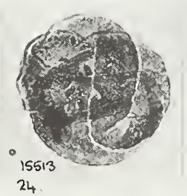
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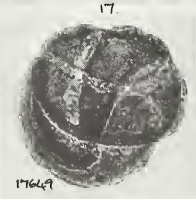
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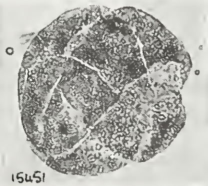
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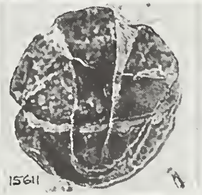
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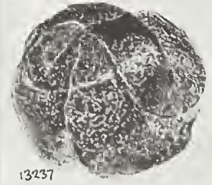
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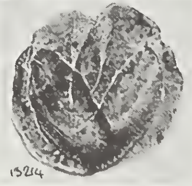
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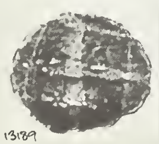
○ Kb.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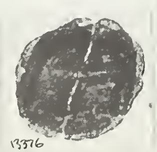
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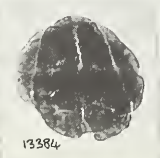
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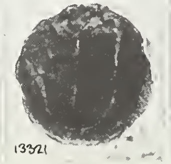
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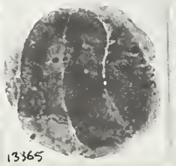
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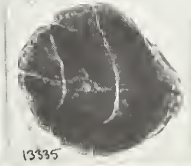
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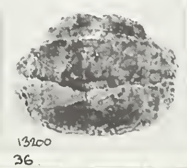
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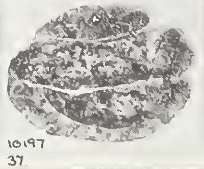
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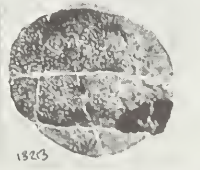
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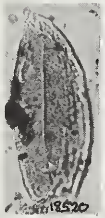
38.

Cycadopites cymbatus (Balme + Henn. '56) Hart '65

● UC 729 550,0

○ UC 608 1262'



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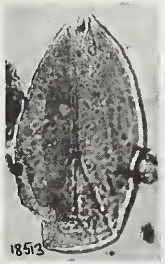

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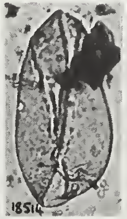

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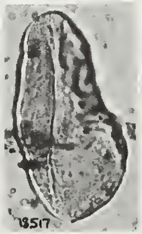

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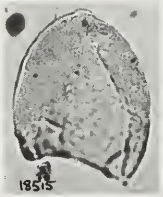

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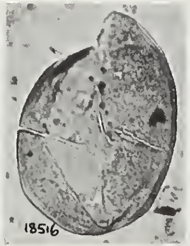

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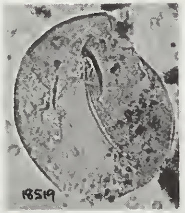

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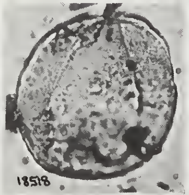

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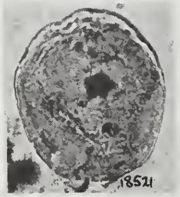

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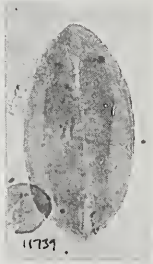
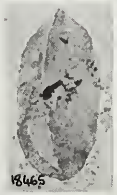


10.

○ SAP6 1152'3", 1152'9"



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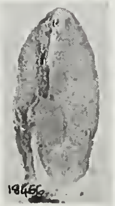

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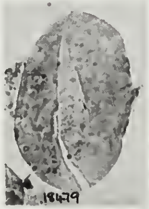

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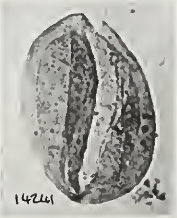

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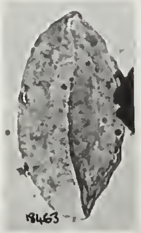

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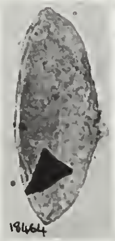

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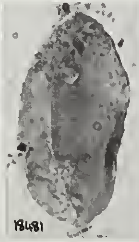

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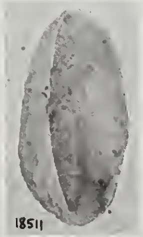

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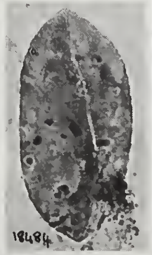

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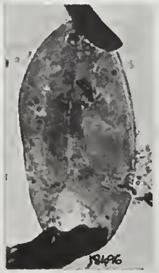
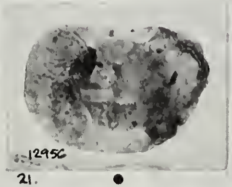


20.

Pinuspollenites thoracatus Balme '70

● WV3 133,50



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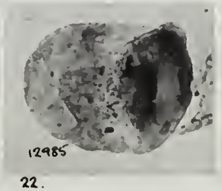

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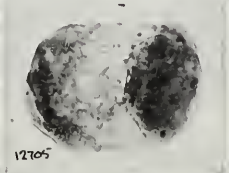

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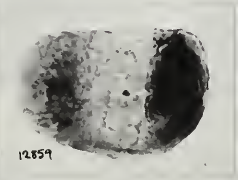

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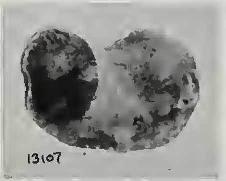

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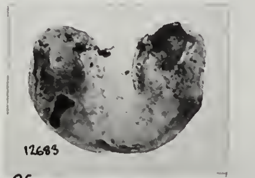

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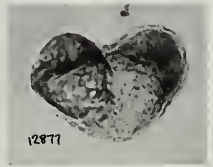

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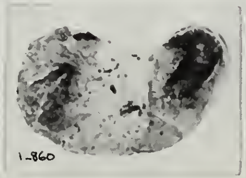

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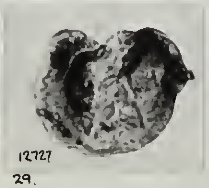

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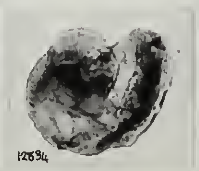

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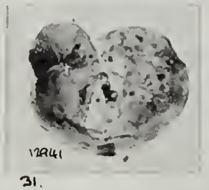

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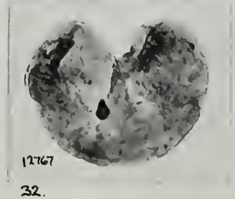
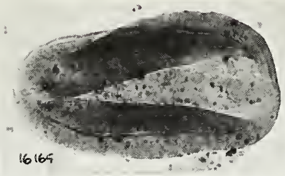


32.

Gnetaceaepollenites sinuosus (Balme & Henn.'56) Bharad.'62

● UC 678 79,0, 80,6



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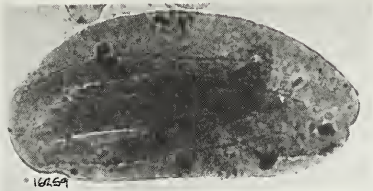

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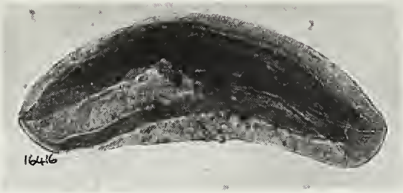

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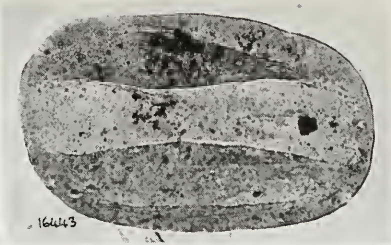

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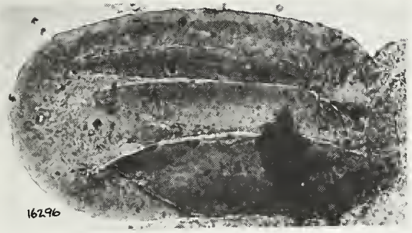

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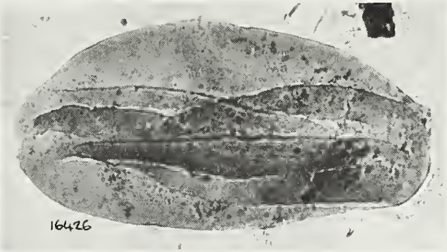

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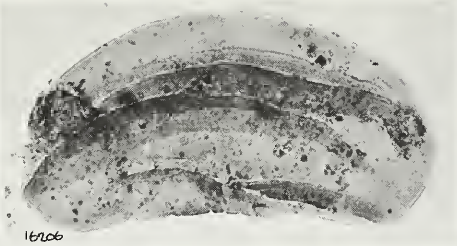

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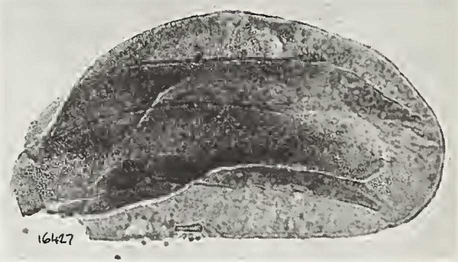

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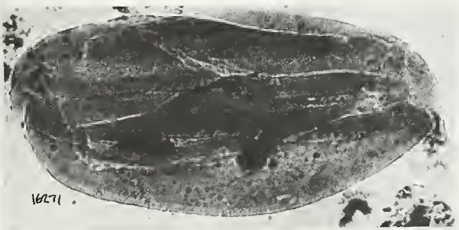

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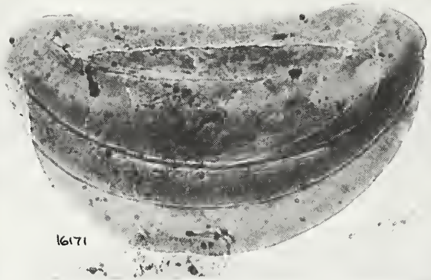

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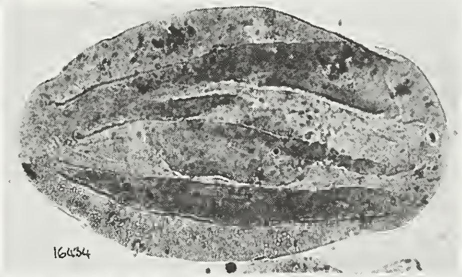

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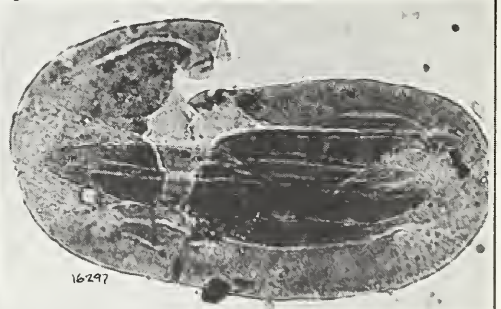

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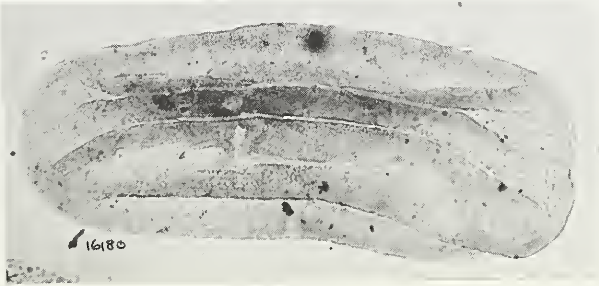

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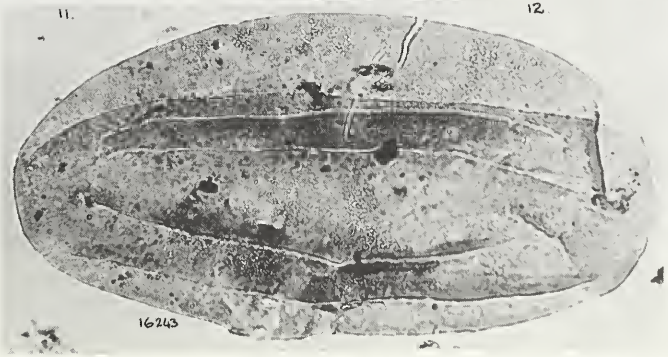
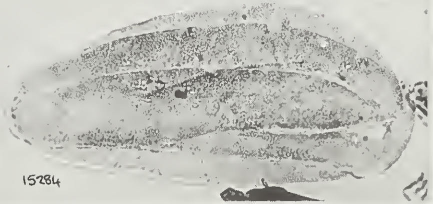


14.

Gnetaceaepollenites sinuosus (Balme + Henn.'56) Bharad.'62

o HKr.



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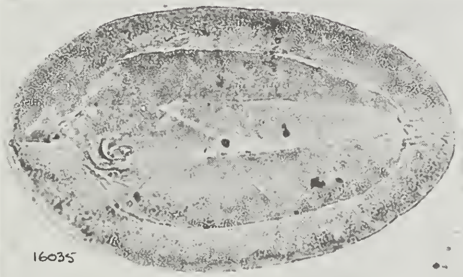

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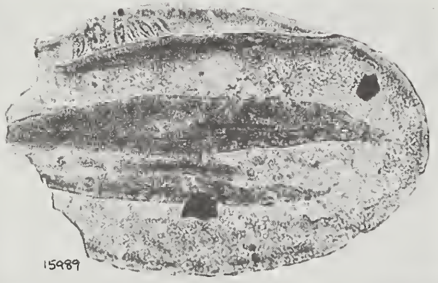

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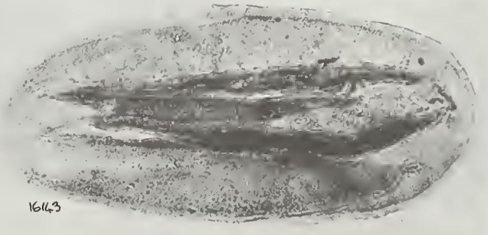

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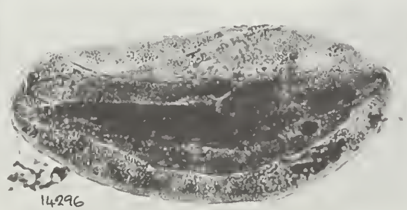

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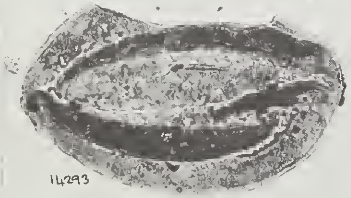

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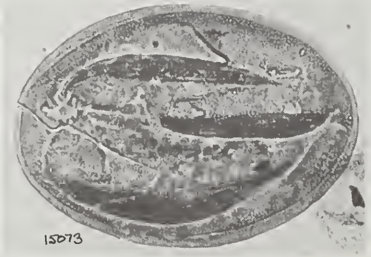
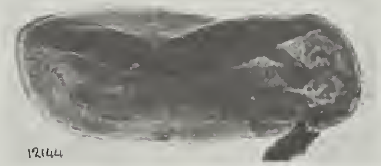


7.

o UC 621 153'



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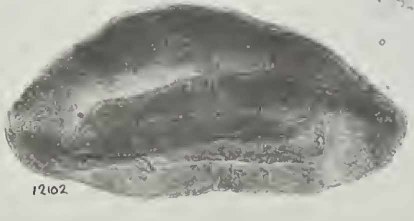

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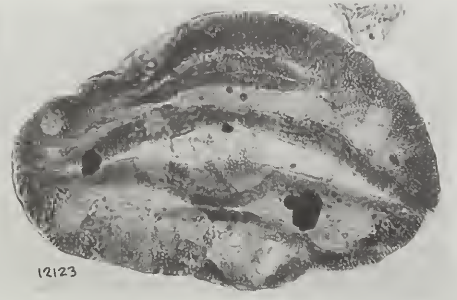

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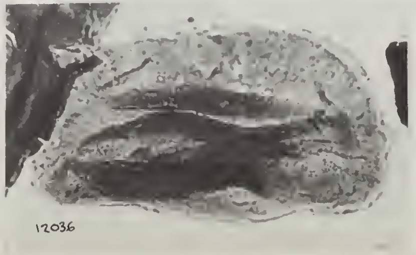

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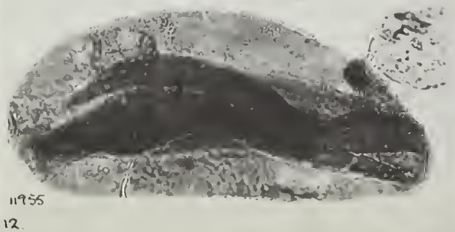
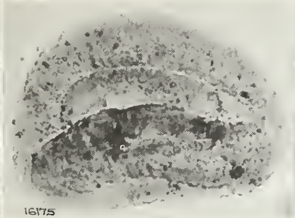


12.

Gnetaceaepollenites ovatus sp.nov.

● UC 678 79,0 ,80,6



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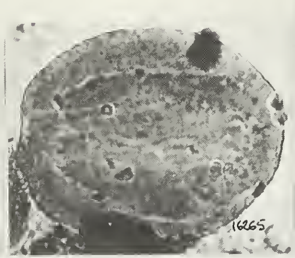

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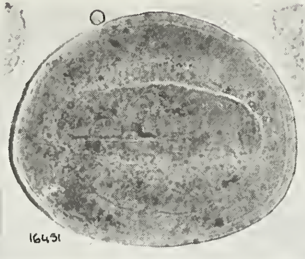

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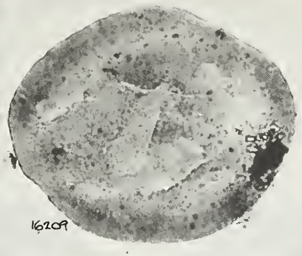

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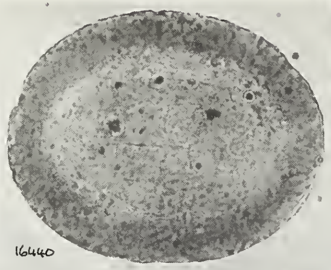

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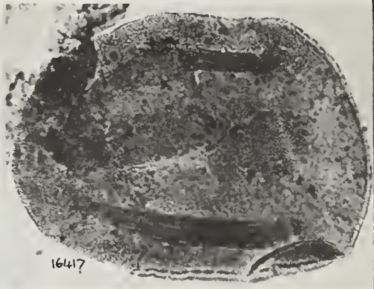

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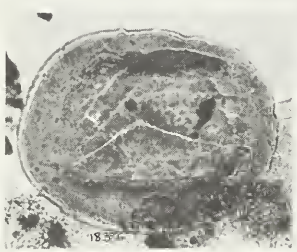

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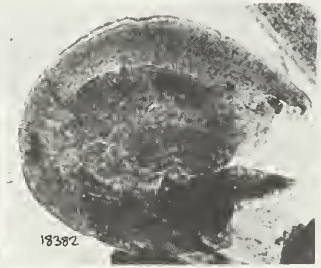

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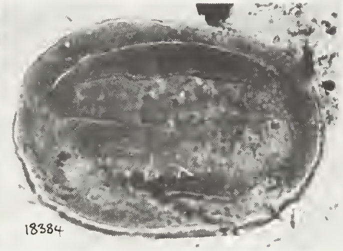

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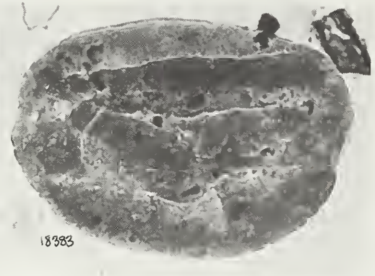

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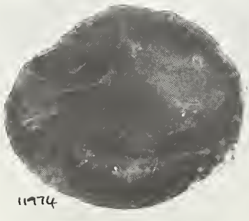
○ UC 621 153'



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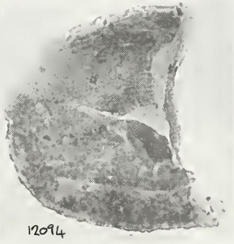

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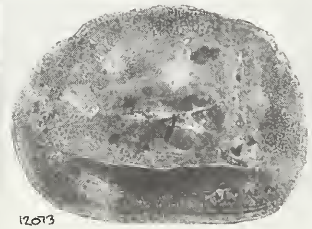
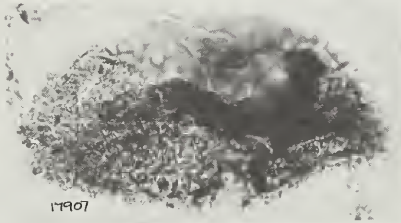


13.

Gnetaceaepollenites bulbiger sp.nov.

○ SAP7 338'



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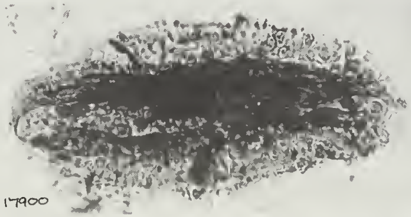

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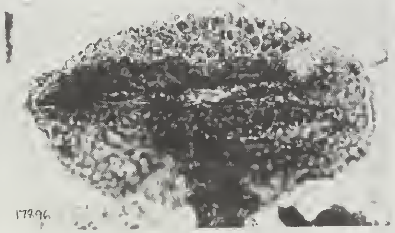

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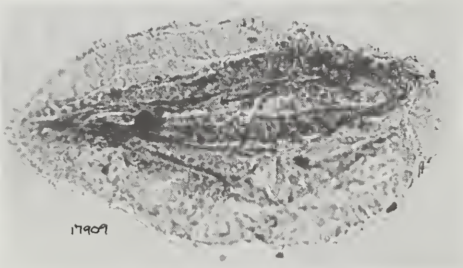

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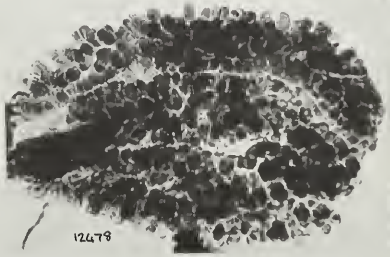
● UC 678 30,6 , 31,6



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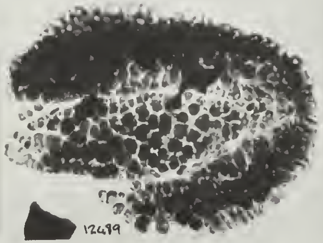

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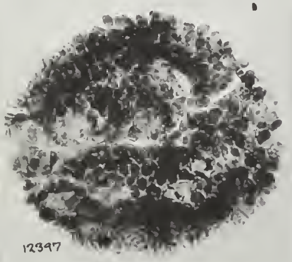

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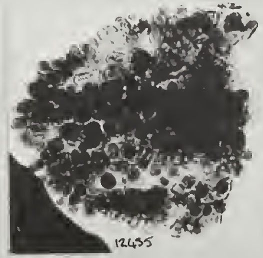

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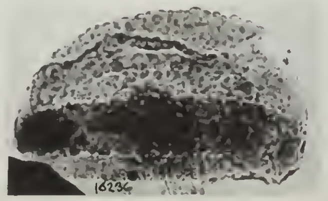
○ UC 678 79,0



9.

MEMOIRS OF THE BOTANICAL SURVEY OF SOUTH AFRICA

MEMOIRS VAN DIE BOTANIESE OPNAME VAN SUID-AFRIKA

The following memoirs are out of print:/Die volgende memoirs is uit druk: Nos. 3, 9, 10, 11, 14, 15, 16, 19, 25, 26, 27 and/en 28.

1. Phanerogamic Flora of the Divisions of Uitenhage and Port Elizabeth-1919-S. Schonland-25c.
2. Botanical Survey of Natal and Zululand-1921-R.D. Aitken & G.W. Gale-15c.
4. A Guide to Botanical Survey Work-1922-25c.
5. Researches on the Vegetation of Natal-1923-J. W. Bews & R.D. Aitken-25c.
7. The Native Timber Trees of the Springbok Flats-1925-Ernest E. Galpin-25c.
8. Researches on the Vegetation of Natal-1925-J. W. Bews & R.D. Aitken-25c.
12. Botanical Survey of the Springbok Flats (Transvaal)-E.E. Galpin-25c.
13. The Vegetation of the Riversdale Area, Cape Province-1929-J. Muir-25c.
16. The Seed-drift of South Africa and some Influences of Ocean Currents on the Strand Vegetation-1937-John Muir-25c.
17. The Vegetation of the Divisions of Albany and Bathurst-1937-R.A. Dyer-25c.
18. Notes on the Vegetation of the Kamiesberg-1938-R.S. Adamson-25c.
19. The Value of Botanical Survey and the Mapping Vegetation as applied to Farming Systems in South Africa-1938-J.A. Pentz-25c.
20. Check-list of the Flowering Plants of the Divisions of George, Knysna, Humansdorp, and Uniondale-1914-H.G. Fourcade-25c.
21. A Reconnaissance Trip through the Eastern Portion of the Bechuanaland Protectorate and an Expedition to Ngamiland, June-July, 1937-1938-I.B. Pole Evans-75c.
22. Roadside Observations on the Vegetation of East and Central Africa-1948-I.B. Pole Evans-R1.
23. The Vegetation of Weenen County, Natal-1951-O. West-75c.
24. An Ecological Account of the Vegetation of the Potchefstroom Area-1951-W.J. Louw-50c.
26. Trees and Shrubs of the Kruger National Park-1951-L.E.W. Codd-75c.
27. A Botanical Survey of the Keiskammahoek District-1951-R. Story-R1.
29. The Wheel-Point Method of Survey-1955-C.E.M. Tidmarsh and C.M. Havenga-75c.
30. Some Plants used by the Bushmen in obtaining Food and Water-1958-R. Story-R1,30.
31. Studies of the Vegetation of Parts of the Bloemfontein and Brandfort Districts-1958-J.W.C. Mostert-R1,95.
32. An Account of the Plant Ecology of the Table Mountain Area of Pietermaritzburg, Natal-1959-D.J.B. Killick-R2.
33. The Vegetation of the Districts of East London and King William's Town, Cape Province-1962-D.M. Comins-R2,40.
34. An Account of the Plant Ecology of the Cathedral Peak area of the Natai Drakensberg-1963-D.J.B. Killick-R2,85; overseas R3,55.
35. Common Names of South African Plants-1966-C.A. Smith-R7,25; overseas R9,10.
36. A Plant Ecological Survey of the Tugela River Basin-1967-D. Edwards. Obtainable from the Town and Regional Planning Commission, Pietermaritzburg, Natal-R5,30 (including maps).
37. Algemene Onkruide in Suid-Afrika/Common Weeds of South Africa-1966-Mayda Henderson and J.G. Anderson-R2,40; overseas R3,55.
38. The Plant Ecology of the Southern Kalahari-1967-O.A. Leistner-R3,20; overseas R4.
39. Flora of Natal-1973-J.H. Ross-R4,25; overseas R5,45.
40. Veld Types of South Africa (second edition)-J.P.H. Acocks-R6,00; overseas R7,50; map R1,20.